World Top 10 University by **2030**

2014 COURSE CATALOG

UNIST

ULSAN NATIONAL INSTITUTE OF SCIENCE AND TECHNOLOGY

UNIST Vision and Goal

Vision

World leading university to advance science and technology for the prosperity of humankind

Goal

To advance into a global top 20 university in science and technology by 2020, top 10 by 2030

Education_ To educate future global leaders with creativity and entrepreneurship

Research_ To promote cutting-edge interdisciplinary research to create a paradigm for green growth

To produce two world-best and ten global star scientists by 2030 (Nobel Prize laureates, winners of the Fields Medal, Lasker Awards, Marie Curie Excellence Awards, etc.)

To create four UNIST global brands

Strategy

Creativity · Interdisciplinary · Globalization · Strategic Focus

Creativity_ Discussion-based teaching utilizing the LMS (Learning Management System)

Interdisciplinary_ Choice of major determined after entry and two or more major tracks required; affiliation with two or more schools obligatory for faculty members

Globalization_ First Korean university to conduct 100% of lectures in English, foreign faculty and student ratio to gradually reach 20%

Strategic Focus_ Determination of focused research areas and establishment of the UNIST Multidisciplinary Institute(UMI)

교 가

박종해 글
김준범 곡


C G C Am Em G7
1.정 기 어 린 가 지 산 해 오 름 보 라
2.맑 고 푸 른 태 화 강 정 기 - 를 받 아
3.서 기 어 린 태 봉 산 아 늑 - 한 품 속
F Em Am D7 G
우 리 는 진 리 의 - 빛 세 기 영 - 재 들
우 리 는 겨 례 의 - 꽃 세 기 영 - 재 들
우 리 는 민 족 의 - 얼 세 기 영 - 재 들
Dm7 G/F Em Am F B Em/G G7
창 의 의 과 학 기 술 기 치 높 이 들 - 고
글 로 벌 과 학 기 술 기 치 높 이 들 - 고
최 첨 단 과 학 기 술 기 치 높 이 들 - 고
C Dm F G7(♭9) C
미 래 로 세 계 로 앞 서 나 아 가 자
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C Am Dm D7 G -/F
인 류 삶 에 공 헌 하 는 세 계 의 선 도 대 - 학
융 합 학 문 개 척 하 는 세 계 의 선 도 대 - 학
조 국 번 영 이 룩 하 는 세 계 의 선 도 대 - 학
E A7 Dm -/D -/F C/G G C
세 시 대 학 문 요 - 람 유 니 스 트 영 원 하 라
세 시 대 리 더 요 - 람 유 니 스 트 영 원 하 라
세 시 대 인 재 요 - 람 유 니 스 트 영 원 하 라

2014 UNIST Academic Calendar

Year	Month	Date	Schedules
2014 Spring Semester	3	1(Sat)	**2014 Spring Semester Begins,** Holiday – Independence Movement Day
		3(Mon)	**Beginning of instruction**
		3(Mon) ~ 5(Wed)	Tuition fee payment for the spring semester
		3(Mon) ~ 7(Fri)	Course Changes and confirmation
		21(Fri)	Course Drop deadline
		28(Fri)	End of first quarter of the semester
	4	21(Mon) ~ 25(Fri)	Mid-term Exams
		25(Fri)	End of second quarter of the semester, Submission deadline for Courses list of the summer session and the fall semester, Leave of Absence application deadline(General)
	5	2(Fri)	Course Withdrawal deadline
		5(Mon), 6(Tue)	Holiday – Children's Day, Holiday – Buddha's Day
		23(Fri)	End of third quarter of the semester, Deadline for "Nomination of Thesis Committee" submission (Graduate school)
		26(Mon) ~ 28(Wed)	Return application for the summer session
	6	3(Tue) ~ 5(Thu)	Course Registration for the summer session
		6(Fri)	Holiday – Memorial Day
		9(Mon) ~ 13(Fri)	Registration for Interdisciplinary major
		16(Mon) ~ 20(Fri)	Final Exams
		23(Mon) ~ 8.31(Sun)	Summer Vacation (10 weeks)
		30(Mon) ~ 8.8(Fri)	Summer Session (6 weeks)
	7	11(Fri)	Grades due for the spring semester
		21(Mon) ~ 8. 1(Fri)	Leave of absence/Return application for the fall semester (on portal-site)
	8	5(Tue) ~ 7(Thu)	Undergraduate Course Registration for the fall semester
		15(Fri)	Holiday – Independence Day
		19(Tue)	Grades due for the summer session
		22(Fri)	Conferral of degrees
		26(Tue) ~ 28(Thu)	Tuition fee payment for the fall semester

Year	Month	Date	Schedules
2014 Fall Semester	9	1(Mon)	2014 Fall semester Begins, Beginning of instruction
		1(Mon) ~ 5(Fri)	Course changes and confirmation
		7(Sun) ~ 10(Wed)	Holiday – Chuseok
		13(Sat)	UNIST Foundation Day
		19(Fri)	Course Drop deadline
		26(Fri)	End of first quarter of the semester
	10	3(Fri)	Holiday – National Foundation Day
		9(Thu)	Holiday – Hangul Proclamation Day
		20(Mon) ~ 24(Fri)	Mid–term exams
		24(Fri)	End of second quarter of the semester, Submission deadline for Courses list of the winter session and the spring semester, 2015, Leave of Absence application deadline(General)
		31(Fri)	Course Withdrawal deadline
	11	21(Fri)	End of third quarter of the semester, Deadline for "Nomination of Thesis Committee " submission (Graduate school)
		24(Mon) ~ 26(Wed)	Return application for the winter session
	12	2(Tue) ~ 4(Thu)	Course Registration for the winter session
		8(Mon) ~ 12(Fri)	Registration for Interdisciplinary major
		15(Mon) ~ 19(Fri)	Final Exams
		22(Mon) ~ 2.28(Sat).2015	Winter Vacation (10 weeks)
		25(Thu)	Holiday – Christmas
		29(Mon) ~ 2.6(Fri).2015	Winter Session (6 weeks)
	2015 1	1(Thu)	Holiday - New Year' s Day
		2(Fri)	Grade due for the fall semester
		19(Mon) ~ 30(Fri)	Leave of absence/Return application for the spring semester, 2015 (on portal–site)
	2	3(Tue) ~ 5(Thu)	Undergraduate Course Registration for the spring semester, 2015
		10(Tue)	Commencement Ceremony
		17(Tue)	Grade due for the winter session
		18(Wed) ~ 20(Fri)	Holiday - Lunar New Year' s Day
		24(Tue) ~ 26(Thu)	Tuition fee payment for the spring semester, 2015

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

2014 Course Catalog
Undergraduate

Contents

Required Credit for Graduation

☐ Engineering Field

Engineering Field					
Major	Major	1st Track/2nd Track		48/18	**66**
		Internship		3	
		Interdisciplinary Project		**P**	
Subtotal					69
Fundamental	Math & Science	Calculus I/Calculus II		6	
		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	Engineering Programming I		3	
		Engineering Programming II		2	
	MGT	Innovation and Entrepreneurship		3	
Subtotal					39
Liberal Arts	English	Group1	Prerequisite: English Foundation	4	
			English Forward, Building Writing/Building Speaking & Grammar : Choose one		
		Group2	English Forward, Building Writing/Building Speaking & Grammar: Choose one		
		Group3	Building Writing/ Building Speaking & Grammar		
	Language	Chinese Foundation/Chinese Forward : Choose one		2	
	AHS	Arts and Creativity		3	Choose seven
		Literature and Creativity		3	
		Globalization and Economy		3	
		Society and Culture		3	
		Evolution of Civilization		3	
		What is "I" ?		3	
		Effective Communication		3	
		Music and Creativity		3	
		Korean History		3	
Subtotal					27
Leadership	ULP	UNIST Leadership Program			8AU
Subtotal					8AU
Total 135 credits / 8AU					

※ Students who entered UNIST in 2009 should take 'UNIST Leadership Program', 4 AU(Activity Unit, 1AU=1Hour/week)

☐ Business Administration Field

Business Administration Field					
Major	Major	1st Track/2nd Track		**48/18**	**66**
		Internship		3	
		Interdisciplinary Project		P	
Subtotal					**69**
Fundamental	Math & Science	Calculus		3	
		Statistics/Applied Linear Algebra		6	
		General Physics		3	
		General Chemistry		3	
		General Biology		3	
	IT	Business Programming		3	
		Business IT		2	
	MGT	Innovation and Entrepreneurship		3	
		Economics		3	
Subtotal					**29**
Liberal Arts	English	Group1	Prerequisite: English Foundation	4	
			English Forward, Building Writing/Building Speaking & Grammar: Choose one		
		Group2	English Forward, Building Writing/Building Speaking & Grammar: Choose one		
		Group3	Building Writing/ Building Speaking & Grammar		
	Language	Chinese Foundation/Chinese Forward : Choose one		2	
	AHS	Arts and Creativity		3	Choose seven
		Literature and Creativity		3	
		Globalization and Economy		3	
		Society and Culture		3	
		Evolution of Civilization		3	
		What is “I” ?		3	
		Effective Communication		3	
		Music and Creativity		3	
		Korean History		3	
Subtotal					**27**
Free Elective	Free Elective			9	
Subtotal					**9**
Leadership	ULP	UNIST Leadership Program			8AU
Subtotal					**8AU**
Total 134 credits / 8AU					

※ Students who entered UNIST in 2009 should take 'UNIST Leadership Program', 4 AU(Activity Unit, 1AU=1Hour/week)

☐ Credit Requirement for Each track

School	Track	Interdisciplinary Major (Requirement/Elective)		
		1st Track	2nd Track	Total
Mechanical and Nuclear Engineering	Mechanical Engineering (MEN)	33/15	9/9	**48/18**
	Nuclear Science and Engineering (NSE)	27/21	12/6	**48/18**
Urban and Environmental Engineering	Environmental Science and Engineering (ESE)	21/27	9/9	**48/18**
	Urban Infrastructure Engineering (UIE)	18/30	9/9	**48/18**
	Disaster Management Engineering (DME)	18/30	9/9	**48/18**
Design and Human Engineering	Industrial Design (ID)	33/15	15/3	**48/18**
	Human and System Engineering (HSE)	33/15	15/3	**48/18**
Materials Science and Engineering	Advanced Materials Science (AMS)	21/27	9/9	**48/18**
	Nano Materials Engineering (NME)	21/27	9/9	**48/18**
Energy and Chemical Engineering	Energy Engineering (ENE)	28/20	12/6	**48/18**
	Chemical Engineering (ACE)	21/27	15/3	**48/18**
Electrical and Computer Engineering	Electrical Engineering (EE)	36/12	18/–	**48/18**
	Computer Science & Engineering (CSE)	36/12	9/9	**48/18**
Life Sciences	Biomedical Engineering (BME)	27/21	12/6	**48/18**
	Biological Sciences (BIO)	23/25	15/3	**48/18**
Natural Science	Physics (PHY)	30/18	12/6	**48/18**
	Chemistry (CHEM)	28/20	12/6	**48/18**
	Mathematical Sciences (MTH)	30/18	18/–	**48/18**
Business Administration	Management (MGT)	33/15	18/–	**48/18**
	Finance & Accounting (FIA)	27/21	18/–	**48/18**

☐ Degree conferred for Each Track

School	Degree	Track	Remark
School of Mechanical and Nuclear Engineering 기계및원자력공학부	B.S. in Mechanical and Nuclear Engineering 공학사	Mechanical Engineering (MEN) 기계공학	
		Nuclear Science and Engineering (NSE) 원자력 공학 및 과학	
School of Urban and Environmental Engineering 도시환경공학부	B.S. in Urban and Environmental Engineering 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 and Systems Engineering (HSE) 인간 및 시스템공학	
School of Materials Science and Engineering 신소재공학부	B.S. in Materials Science and Engineering 공학사	Advanced Materials Science (AMS) 신소재과학	
		Nano Materials Engineering (NME) 나노재료공학	
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 Biomedical Engineering 공학사	Biomedical Engineering (BME) 생명공학	
	B.S. in Biological Sciences 이학사	Biological Sciences (BIO) 생명과학	
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	

□ 2014 Curriculum Applicability and Interim Measures

○ The Curriculum is applied to following students:

- School entrants since 2014
- School entrants before 2014 who changed new tracks in and after 2014

Students who entered before 2014 are eligible to graduate in accordance with the 2013 curriculum and can also graduate in their new school. Students who changed into new tracks should take the courses in accordance with the 2014 curriculum.

○ Interim Measures

- Interdisciplinary Project is a non-credit project (P/F) for graduation.
- Each course of Dynamics of IT(3) and Leadership and Teamwork(3) is changed into a major of business administration. Students who take or do not take the courses must follow the directions of [Table 1].
- In case particular courses or tracks have been abolished, students should take designated alternative courses in place of the discontinued courses. (Refer to p.205, Alternative curriculum for 2013 curriculum)

[Table 1]

Classification	DIT (IT course designated by school)	Leadership and Teamwork	Interdisciplinary Project
	If you have not taken		
2009~2012 entrants in accordance with 2013 curriculum (33/27)	Take IT courses required by each school(Refer to Table 2)	Earn 3 credits from any courses	Track Required (1 credit for each) Total 2 credits
	If you have taken		
2009~2013 entrants in accordance with 2014 curriculum (48/18)	Credited as Major	Engineering: Credited as AHS Management: Credited as Major	Non-credit project (P/F)

[Table 2]

▶ **Required IT Courses (For students who entered 2009~2012 and majored track before 2014)**

School	Programming	Practical IT	Designated course by the school		
			Track	Course No.	Title
Mechanical and Nuclear Engineering	Engineering Programming I	Engineering Programming II	SDM, TFP	MEN250	Mechanical drawing and Lab
			Nuclear Science and Engineering	NSE480	Introduction to Nuclear Engineering IT
Urban and Environmental Engineering	Engineering Programming I	Engineering Programming II	Numerical Modeling and Analysis		
Design & Human Engineering	Engineering Programming I	Engineering Programming II	Interactive Technology Computational Tools for Engineers : choose 1		
			Track	Course No.	Title
Materials Science and Engineering	Engineering Programming I	Engineering Programming II	MSE	AMS390	Introduction to Computational Materials Science
			Track	Course No.	Title
Energy and Chemical Engineering	Engineering Programming I	Engineering Programming II	Energy Engineering	ENE480	Scientific Expression with IT
			Chemical Engineering	ACE301	Computational Methods for Chemical Engineering
Electrical and Computer Engineering	Engineering Programming I	Engineering Programming II	Digital System Lab		
			Track	Course No.	Title
Life Sciences	Engineering Programming I	Engineering Programming II	Biomedical Engineering	BME301	Computational Methods for Biosciences and Bioengineering
			Biological Sciences	ACE301 or BME301	Computational Methods for Chemical Engineering or Computational Methods for Biosciences and Bioengineering
			Track	Course No.	Title
Natural Science	Engineering Programming I	Engineering Programming II	NCS	ACE301 or BME301	Computational Methods for Chemical Engineering or Computational Methods for Biosciences and Bioengineering

School	Programming	Practical IT	Designated course by the school
Business Administration	Business Programming	Business IT	Dynamics of IT

※ Complete based on 1T

☐ Required Fundamentals (when students choose tracks from another field)

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

Course Title	School of Mechanical and Nuclear Engineering		School of Urban and Environmental Engineering			School of Design & Human Engineering	
	MEN	NSE	ESE	UIE	DME	ID	HSE
Calculus I	A	A	A	A	A	A	A
Calculus II	R	R	O	O	O	O	R
Applied Linear Algebra	A	A	A	A	A	A	A
Differential Equations	R	R	R	R	R	O	O
Statistics	–	–	A	A	A	A	A
General Physics I	R	R	A	A	A	A	A
General Physics II	R	R	O	O	O	O	O
General Chemistry I	A	A	A	A	A	A	A
General Chemistry II	O	O	O	O	O	O	O
General Physics Lab I	R	R	O	O	O	O	O
General Physics Lab II	R	R	O	O	O	O	O
General Chemistry Lab I	O	O	O	O	O	O	O
General Chemistry Lab II	O	O	O	O	O	O	O

Course Title	School of Materials Science and Engineering		School of Energy and Chemical Engineering		School of Electrical and Computer Engineering	
	AMS	MNE	ENE	ACE	EE	CSE
Calculus I	A	A	R	A	A	A
Calculus II	O	O	R	O	O	O
Applied Linear Algebra	A	A	A	A	A	A
Differential Equations	R	R	A	R	R	R
Statistics	–	–	–	–	–	–
General Physics I	A	A	R	A	A	A
General Physics II	R	R	R	R	R	R
General Chemistry I	R	R	R	R	O	O
General Chemistry II	R	R	R	R	O	O
General Physics Lab I	R	R	O	O	R	R
General Physics Lab II	R	R	O	O	R	R
General Chemistry Lab I	R	R	O	R	O	O
General Chemistry Lab II	R	R	O	R	O	O

Course Title	School of Life Sciences		School of Natural Science		
	BME	BIO	PHY	CHEM	MTH
Calculus I	A	A	A	A	A
Calculus II	O	O	R	O	R
Applied Linear Algebra	A	A	A	A	A
Differential Equations	R	O	R	O	R
Statistics	–	A	–	O	O
General Physics I	A	A	R	A	A
General Physics II	R	O	R	O	O
General Chemistry I	R	R	O	A	A
General Chemistry II	R	R	O	R	O
General Physics Lab I	O	O	R	O	O
General Physics Lab II	O	O	R	O	O
General Chemistry Lab I	O	O	O	R	O
General Chemistry Lab II	O	O	O	R	O

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

Course Title	School of Business Administration	
	MGT	FIA
Innovation and Entrepreneurship	R	R
Economics	R	R

R : Required A : Accepted O : Optional

☐ Interdisciplinary Project

1. Description

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. Lastly, students will present their work in public for evaluation.

2. Process

○ When : During the final semester before graduating

※ It may be started in the 1st semester of senior year depending on each schools

○ How-to :

- Apply for the Interdisciplinary Project on Portal site during the course registration period
- Consulting 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)

○ Process :

Project Assignment → <Interdisciplinary Project> Implementation → Presentation and Evaluation → Grading → Credit given during the grade entry period every semester

Division of General Studies

1. School Introduction

Students enter UNIST into Science/Technology Group and Management Group. DGS is responsible for their basic science and cultural education during their freshmen year. Upon completing freshmen curricula at DGS successfully, students choose their special field (division/department/track) according to the UNIST regulation for the next level education.
DGS offers courses in Mathematics and basic sciences (Physics, Chemistry, Biology) as well as basic IT and management courses that would provide solid foundation for students when they study major fields of their choice.
In order to cultivate a wide intellectual horizon, an innovative creativity, and a harmonious personality through cooperative endeavor for each student we offer essential courses in Humanities, Social sciences, English, and Arts.

2. 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) Free Elective

The field is formed with free elective courses. It should offer various courses, so the students can attend the courses more freely.

8) UNIST Leadership Program

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

□ Engineering Field

Course	Course is	Course No.	Course Title	Course Title(Kor.)	Cred.–Lect.–Exp.	Prerequisite
Fundamental	M&S	MTH111	Calculus I	미적분학 I	3–3–1	
		MTH112	Calculus II	미적분학 II	3–3–1	MTH111
		MTH103	Applied Linear Algebra	응용선형대수	3–3–0	
		MTH201	Differential Equations	미분방정식	3–3–0	MTH111 or MTH101
		MTH211	Statistics	통계학	3–3–0	
		PHY101 (PHY102)	General Physics I (General Physics I H)	일반물리학 I (고급일반물리학 I)	3–3–0	() is honor class
		PHY103 (PHY104)	General Physics II (General Physics II H)	일반물리학 II (고급일반물리학 II)	3–3–0	() is honor class
		PHY107	General Physics Lab I	일반물리학실험 I	1–0–2	
		PHY108	General Physics Lab II	일반물리학실험 II	1–0–2	
		CHM101	General Chemistry I	일반화학 I	3–3–0	
		CHM102	General Chemistry II	일반화학 II	3–3–0	
		CHM105	General Chemistry Lab I	일반화학실험 I	1–0–2	
		CHM106	General Chemistry Lab II	일반화학실험 II	1–0–2	CHM101 and CHM105
		BIO101	General Biology	일반생물	3–3–0	
	IT	ITP107	Engineering Programming I	공학프로그래밍 I	3–2–2	
		ITP117	Engineering Programming II	공학프로그래밍 II	2–1–2	
	MGT	MGT102	Innovation and Entrepreneurship	기업가정신과 혁신	3–3–0	
Liberal Arts	ENG	(ENG100)	English Foundation	English Foundation	Prerequisite	
		ENG107	English Forward	English Forward	2–2–0	English Foundation
		ENG108	Building Writing	Building Writing	2–2–0	ENG107
		ENG109	Building Speaking &Grammar	Building Speaking &Grammar	2–2–0	ENG107
	LNG	LNG201	Chinese Foundation	Chinese Foundation	2–2–0	
		LNG202	Chinese Forward	Chinese Forward	2–2–0	
	AHS	AHS101	Arts and Creativity	예술과 창의성	3–3–0	
		AHS102	Literature and Creativity	문학과 창의성	3–3–0	
		AHS103	Globalization and Economy	세계화와 글로벌경제	3–3–0	
		AHS104	Society and Culture	사회와 문화	3–3–0	
		AHS105	Evolution of Civilization	문명의 발전	3–3–0	
		AHS106	What is "I"?	나의 정체성	3–3–0	
		AHS107	Effective Communication	효과적 커뮤니케이션	3–3–0	
		AHS108	Music and Creativity	음악과 창의성	3–1–2	
		AHS109	Korean History	한국사	3–3–0	
		AHS110	* Special Topics in Korean Studies	한국학 특강	3–3–0	
		AHS112	Gender Partnership in Engineering	성인지와 공학	3–3–0	

* Required course for only international students who enter from 2014 onwards.
※ Foreign students should take 'Korean Language I,II (LNG203,204)' instead of 'Chinese Language (LNG201, LNG202)'

☐ Business Administration Field

Course	Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Fundamental	M&S	MTH101	Calculus	미적분학	3-3-1	
		MTH103	Applied Linear Algebra	응용선형대수	3-3-0	
		PHY105	General Physics	일반물리학	3-3-0	
		CHM103	General Chemistry	일반화학	3-3-0	
		BIO101	General Biology	일반생물	3-3-0	
		MTH211	Statistics	통계학	3-3-0	
	IT	ITP108	Business Programming	Business Programming	3-3-0	
		ISM202	Business IT	Business IT	2-2-0	
	MGT	MGT102	Innovation and Entrepreneurship	기업가정신과 혁신	3-3-0	
		MGT106	Economics	경제원론	3-3-0	
Liberal Arts	ENG	(ENG100)	English Foundation	English Foundation	Prerequisite	
		ENG107	English Forward	English Forward	2-2-0	English Foundation
		ENG108	Building Writing	Building Writing	2-2-0	ENG107
		ENG109	Building Speaking &Grammar	Building Speaking &Grammar	2-2-0	ENG107
	LNG	LNG201	Chinese Foundation	Chinese Foundation	2-2-0	
		LNG202	Chinese Forward	Chinese Forward	2-2-0	
	AHS	AHS101	Arts and Creativity	예술과 창의성	3-3-0	
		AHS102	Literature and Creativity	문학과 창의성	3-3-0	
		AHS103	Globalization and Economy	세계화와 글로벌경제	3-3-0	
		AHS104	Society and Culture	사회와 문화	3-3-0	
		AHS105	Evolution of Civilization	문명의 발전	3-3-0	
		AHS106	What is "I"?	나의 정체성	3-3-0	
		AHS107	Effective Communication	효과적 커뮤니케이션	3-3-0	
		AHS108	Music and Creativity	음악과 창의성	3-1-2	
		AHS109	Korean History	한국사	3-3-0	
		AHS110	* Special Topics in Korean Studies	한국학 특강	3-3-0	
		AHS112	Gender Partnership in Engineering	성인지와 공학	3-3-0	
Free Elective	English	ENG106	Introduction to English Styles	Introduction to English Styles	3-3-0	ENG107
		ENG110	English Language &Culture	English Language &Culture	3-3-0	ENG107
		ENG111	English for Business	English for Business	3-3-0	ENG107
		ENG112	English for Science and Technology	English for Science and Technology	3-3-0	ENG107
		ENG113	Academic Reading and Writing	Academic Reading and Writing	3-3-0	ENG107
	AHS	AHS111	Sports and Health	스포츠와 건강	1-0-2	

* Required course for only international students who enter from 2014 onwards.

※ Foreign students should take 'Korean Language I,II (LNG203,204)' instead of 'Chinese Language (LNG201, LNG202)'

☐ AHS (Arts, Humanities & Social Sciences)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite/credit
Required	AHS101	Arts and Creativity	예술과 창의성	3-3-0	Choose seven /21
	AHS102	Literature and Creativity	문학과 창의성	3-3-0	
	AHS103	Globalization and Economy	세계화와 글로벌경제	3-3-0	
	AHS104	Society and Culture	사회와 문화	3-3-0	
	AHS105	Evolution of Civilization	문명의 발전	3-3-0	
	AHS106	What is "I"?	나의 정체성	3-3-0	
	AHS107	Effective Communication	효과적 커뮤니케이션	3-3-0	
	AHS108	Music and Creativity	음악과 창의성	3-1-2	
	AHS109	Korean History	한국사	3-3-0	
	AHS110	* Special Topics in Korean Studies	한국학 특강	3-3-0	
	AHS112	Gender Partnership in Engineering	성인지와 공학	3-3-0	
Free Elective	AHS111	Sports and Health	스포츠와 건강	1-0-2	

* Required course for only international students who enter from 2014 onwards.

☐ Recommended Course Schedules

▶ Math&Science

Year/Sem.	I (Spring)	II (Fall)	Remark
1	MTH101 MTH111 PHY101 (PHY102) PHY105 PHY107 CHM101 CHM105 BIO101	MTH101 MTH111 MTH112 PHY103 (PHY104) PHY108 CHM102 CHM103 CHM106 BIO101	

▶ IT Courses

Year/Sem.	I (Spring)	II (Fall)	Remark
1	ITP107 ITP108 ITP117 ISM202	ITP107 ITP108 ITP117 ISM202	

▶ MGT

Year/Sem.	I (Spring)	II (Fall)	Remark
1	MGT102 MGT106	MGT102	

▶ English / Language

Year/Sem.	I (Spring)	II (Fall)	Remark
1~2	ENG107 ENG108 ENG109 ENG110 ENG111 ENG113 LNG201 LNG202	ENG106 ENG107 ENG108 ENG109 ENG112 ENG113 LNG201 LNG202	

▶ AHS

Year/Sem.	I (Spring)	II (Fall)	Remark
1~2	AHS101 AHS102 AHS103 AHS104 AHS105 AHS106 AHS107 AHS108 AHS110	AHS101 AHS102 AHS103 AHS104 AHS105 AHS106 AHS107 AHS108 AHS110	※ AHS112 course will be offered in summer session, 2014.

☐ Required Mathematics Course for Each Track (for Engineering Field)

School	Track	Course No.	Required Mathematics course	Semester
Mechanical and Nuclear Engineering	Mechanical Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
	Nuclear Science and Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
Urban and Environmental Engineering	Environmental Science and Engineering	MTH201	Differential Equations	2-1
		MTH103 or MTH211	**Choose One Between:** Applied Linear Algebra, Statistics	2-2
	Urban Infrastructure Engineering	MTH201	Differential Equations	2-1
		MTH103 or MTH211	**Choose One Between:** Applied Linear Algebra, Statistics	2-2
	Disaster Management Engineering	MTH201	Differential Equations	2-1
		MTH103 or MTH211	**Choose One Between:** Applied Linear Algebra, Statistics	2-2
Design & Human Engineering	Industrial Design	MTH103	Applied Linear Algebra	2-1
		MTH211	Statistics	2-2
	Human & Systems Engineering	MTH103	Applied Linear Algebra	2-1
		MTH211	Statistics	2-2
Materials Science and Engineering	Advanced Materials Science	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Nano Materials Engineering	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
Energy and Chemical Engineering	Energy Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
	Chemical Engineering	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
Electrical and Computer Engineering	Electrical Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
	Computer Science & Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
Life Sciences	Biomedical Engineering	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Biological Sciences	MTH103	Applied Linear Algebra	2-1
		MTH211	Statistics	2-2
Natural Science	Chemistry	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Mathematical Sciences	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Physics	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
Business Administration	Management	MTH103	Applied Linear Algebra	1-2
		MTH211	Statistics	1-2
	Finance & Accounting	MTH103	Applied Linear Algebra	1-2
		MTH211	Statistics	1-2

□ Required Fundamentals (when students choose tracks from another field)

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

Course Title	School of Mechanical and Nuclear Engineering		School of Urban and Environmental Engineering			School of Design & Human Engineering	
	MEN	NSE	ESE	UIE	DME	ID	HSE
Calculus I	A	A	A	A	A	A	A
Calculus II	R	R	O	O	O	O	R
Applied Linear Algebra	A	A	A	A	A	A	A
Differential Equations	R	R	R	R	R	O	O
Statistics	–	–	A	A	A	A	A
General Physics I	R	R	A	A	A	A	A
General Physics II	R	R	O	O	O	O	O
General Chemistry I	A	A	A	A	A	A	A
General Chemistry II	O	O	O	O	O	O	O
General Physics Lab I	R	R	O	O	O	O	O
General Physics Lab II	R	R	O	O	O	O	O
General Chemistry Lab I	O	O	O	O	O	O	O
General Chemistry Lab II	O	O	O	O	O	O	O

Course Title	School of Materials Science and Engineering		School of Energy and Chemical Engineering		School of Electrical and Computer Engineering	
	AMS	MNE	ENE	ACE	EE	CSE
Calculus I	A	A	R	A	A	A
Calculus II	O	O	R	O	O	O
Applied Linear Algebra	A	A	A	A	A	A
Differential Equations	R	R	A	R	R	R
Statistics	–	–	–	–	–	–
General Physics I	A	A	R	A	A	A
General Physics II	R	R	R	R	R	R
General Chemistry I	R	R	R	R	O	O
General Chemistry II	R	R	R	R	O	O
General Physics Lab I	R	R	O	O	R	R
General Physics Lab II	R	R	O	O	R	R
General Chemistry Lab I	R	R	O	R	O	O
General Chemistry Lab II	R	R	O	R	O	O

Course Title	School of Life Sciences		School of Natural Science		
	BME	BIO	PHY	CHEM	MTH
Calculus I	A	A	A	A	A
Calculus II	O	O	R	O	R
Applied Linear Algebra	A	A	A	A	A
Differential Equations	R	O	R	O	R
Statistics	–	A	–	O	O
General Physics I	A	A	R	A	A
General Physics II	R	O	R	O	O
General Chemistry I	R	R	O	A	A
General Chemistry II	R	R	O	R	O
General Physics Lab I	O	O	R	O	O
General Physics Lab II	O	O	R	O	O
General Chemistry Lab I	O	O	O	R	O
General Chemistry Lab II	O	O	O	R	O

▶ Fundamentals required to Engineering field students when they choose Business administration field tracks

Course Title	School of Business Administration	
	MGT	FIA
Innovation and Entrepreneurship	R	R
Economics	R	R

R : Required A : Accepted O : Optional

▶ For Business administration field students who choose Engineering field track as their 2nd track

1. Students who complete General Physics in 2009 → They don't have to take General Physics I (In 2009, General Physics I and General Physics were designated as similar courses)
2. Students who didn't take General Physics in 2009 → They should take General Physics I if it is required by their 2nd track (Refer to the table above)

▶ Required Courses to Take When Change the Field

1. Business Administration field -> Engineering Field

Category	Course	Remarks
Accepted	Calculus = Calculus I	
	Business Programming = Engineering Programming I	
Identical	Applied Linear Algebra = Applied Linear Algebra	
	Statistics = Statistics	
	General Biology = General Biology	

2. Engineering Field -> Business Administration Field

Category	Course	Remarks
Accepted	Calculus I = Calculus	
	Engineering Programming I = Business Programming	
	General Physics I = General Physics	
	General Chemistry I = General Chemistry	
Identical	Applied Linear Algebra = Applied Linear Algebra	
	Statistics = Statistics	
	General Biology = General Biology	

□ History of Fundamental Courses Change of 2009-2013 [Correspondence/Substitution]

Acad. Yr.	2009		2010
Math	MTH101 Calculus (3)	⇨	MTH111 Calculus I (3) MTH112 Calculus II (3)
			MTH101 Calculus (3)

※ Student who already took Calculus in 2009 should take 'Applied Linear Algebra, Differential Equations, Statistics' 3 courses.

Acad. Yr.	2009		2013
Science	CHE104 General Chemistry Lab (2)	⇨	CHE105 General Chemistry Lab I (1)
			CHE106 General Chemistry Lab II (1)
	PHY106 General Physics Lab (2)	⇨	PHY107 General Physics Lab I (1)
			PHY108 General Physics Lab II (1)

Acad. Yr.	2009		2010		2011
GMT	GMT105 Economics (3)	⇨	GMT105 Microeconomics (3)	⇨	GMT106 Economics (3)

Acad. Yr.	2009-1		2009-2		2010		2013
IT	ITP103 Java (2)	⇨	ITP106 Intro. to Programming (3)	⇨	ITP107 Engineering Programming (3)	⇨	ITP107 Engineering Programming I (3)
	ITP104 C++ (2)				ITP108 Business Programming (3)	⇨	ITP108 Business Programming (3)

Acad. Yr.	2009-1		2009-2		2011		2013
IT	ITP101 Excel (2)	⇨	ITP105 Practical IT (2)	⇨	ITP117 Engineering Programming Lab (2)	⇨	ITP117 Engineering Programming II (2)
	ITP102 Access (2)				ISM202 Dynamics of IT Lab (2)	⇨	ISM202 Business IT (2)

Acad. Yr.	2009		2012		2013
IT	ISM201 Dynamics of IT (3)	⇨	ISM201 Dynamics of IT (3) or designated course by ENG school	⇨	IT course designated by ENG school (3)
					ISM201 Dynamics of IT (3)

Acad. Yr.	2009		2010
English	ENG101 Intermediate English (2)	⇨	ENG107 English Forward (2)
	ENG102 Advanced English (2)	⇨	ENG108 Building Writing (2) ENG109 Building Speaking & Grammar (2)
Free Elec.	ENG103 Building English Writing (2)	⇨	ENG110 English Language & Culture (3)
	ENG104 Building English Grammar for Speaking (2)	⇨	ENG111 English for Business (3)
	ENG105 English24 (3)	⇨	ENG106 Intro. to English Styles (3)

4. Course Descriptions

▶ Math & Science

MTH101 Calculus [미적분학]

Calculus 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.

MTH111 Calculus I [미적분학 I]

Calculus 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.

MTH103 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.

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.

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 technology management.

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, metabolism, reproduction, and genetics. The laboratory activities will demonstrate some of the concepts presented in lecture and will introduce the student to the scientific method and techniques. Each class will consist of two lectures per week and one laboratory class per month.

▶ Management

MGT102 Innovation and Entrepreneurship [기업가정신과 혁신]

This course offers a framework for understanding the entrepreneurial process faced by entrepreneurs, and perspectives that seek to understand how technological innovation and new business development can generate growth and economic value. Theoretical models, practical tools and business cases are discussed in the class.

MGT106 Economics [경제학 원론]

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.

▶ IT

ITP107 Engineering Programming I [공학프로그래밍 I]

This course introduces the fundamental concepts and methodology of computer programming, especially in C++. This course aims at providing students with basic programming skills along with clear understanding of the state-of-the-art computer program design concepts. The scope of this course includes the syntax of ANSI standard C++, which covers expression syntax, decision making, loops, functions, arrays, algorithm design, and so on. Students will also learn how to design, compile, test, and debug C++ programs, through relevant laboratory sessions.

ITP117 Engineering Programming II [공학프로그래밍 II]

In this course, students will gain hands-on experience in C++ programming at real software and hardware platforms. This course includes lecture session and a laboratory session that take place once a week, respectively. Lecture sessions will provide the basic programming skills that are not covered by Engineering Programming, but are necessary for the given platforms. Laboratory sessions will emphasize the implementation of C++ programs in the given platforms. Students will plan and design their own term project through the laboratory sessions, and aiming at interdisciplinary and creative work.

ITP108 Business Programming

This course aims at providing attendees with understanding of the computer system mechanisms along with basic programming skills. The scope of this course includes the principles of computer systems, organization of computer hardware, as well as the basic elements of Visual Basic programming such as its syntax, program structures, data types, arithmetic operations, functions, loops, and branch operations.

ISM202 Business IT

This course is an introduction to the major components of MS Office software for personal and organizational productivity improvement. Focus is on MS Excel and MS Access for spreadsheet and database applications through covering features in MS Excel such as working and formatting worksheets, using formulas and functions, creating and modifying charts, and using analytical options and Macros; and those in MS Access such as creating tables, forms, & reports, entering/editing/deleting/displaying data, sorting/filtering records, queries, expressions, sharing data between applications.

▶ English

ENG100 English Foundation (no-credit)

This course is offered for students who need basic training in reading and listening in order to take regular-credit English courses. The students will study materials on-line and are required to pass an exit test.

ENG106 Introduction 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

ENG107 English Forward

This course is the general English class which focuses on training in English listening and discussion. The major goal of the course is to help UNIST students grow more autonomous in learning English through the experience of the virtual English course. The students will actively participate in on-line learning and in-class discussions of the studied listening materials.

ENG108 Building Writing

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

ENG109 Building Speaking & Grammar

This course is a practice of English speaking and conversation in relation to appropriate uses of English grammar in speaking. The students are expected to develop fluency and accuracy in English speaking by learning through on-line materials and participating in classroom activities.

ENG110 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.

ENG111 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.

ENG112 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.

ENG113 Academic Reading and Writing

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.

▶ Foreign Languages

LNG201 Chinese Foundation [초급 중국어]

This is a lecture and discussion-based course. Chinese Foundation is not open to students who have learned, from whatever source, enough Chinese to qualify for more advanced courses. It is an introduction to fundamentals of standard Chinese, including pronunciation, grammar, and Chinese characters, with emphasis on all basic language skills (speaking, listening comprehension, reading, and writing).

LNG202 Chinese Forward [중급 중국어]

This is a lecture and discussion-based course. Recommended preparation for Chinese Forward is the ability to speak and understand Mandarin or other Chinese dialects at elementary levels. It is designed for students who already have listening and speaking skills in Mandarin or other Chinese dialects at elementary levels. Training in all basic language skills (speaking, listening, reading, and writing).

▶ AHS

AHS101 Arts and Creativity [예술과 창의성]

Arts and creativity are inseparable, in as much as a piece of art cannot be born without creativity. More importantly, artistic creativity is not limited to arts. The significance of creativity has been widely recognized as essential to problem-solving skills. In this course, students will look at various examples of artistic creativity and in so doing, they will be expected to nurture their creativity.

AHS102 Literature and Creativity [문학과 창의성]

Creativity has been perceived as important because it is recognized as essential to problem-solving skills. This course aims at looking into the dynamic relationship between literature and creativity. In doing so, we will explore major genres of literature and the mechanisms of creativity. The intersection of literature and science will be given special attention as well.

AHS103 Globalization and Economy [세계화와 글로벌경제]

This course focuses on how the growing impact of globalization is transforming the economy and culture of the world. It also discusses the issues on how to deal with the fast changing structures of the economy and market as globalization is being accelerated.

AHS104 Society and Culture [사회와 문화]

Cultural diversity has become an important issue in Korea as it is worldwide. In response to the social conditions of globalized society, this course aims at familiarizing students with diverse societies and cultures. Understanding other cultures will lead students to a better appreciation of their own culture. Ultimately, this course will prepare students to contribute to the global society.

AHS105 Evolution of Civilization [문명의 발전]

This course aims to investigate the factors behind the stages of civilizations. It provides causal explanations of why some civilizations rose and fell in the past. Students will improve not only the ability to analyze history but also think critically about it. An emphasis can be put on the impact science and technology had on the evolution of civilizations.

AHS106 What is "I"? [나의 정체성]

This course is an attempt to answer the question, What is “I”?, drawing upon multiple disciplines: philosophy, psychology, computer science, neuroscience, biology, and physics. We aim to increase our ability to think critically and communicate effectively by being engaged in argumentations over the issues concerning logic, morality, happiness, death, mind, science, religion, and self.

AHS107 Effective Communication [효과적 커뮤니케이션]

This course will improve the students' ability to communicate effectively, which is essential for success in both the professional and academic worlds. In order to become a more skillful and effective communicator, students will learn about the basic theories and techniques of presentations, as well as technical writing. The class will give students the opportunity to practice these two skills. Also, critiques and feedback of all oral and written performances will be given.

AHS108 Music and Creativity [음악과 창의성]

The course opens students to the possibilities of creative expression in music, through instruction in the fundamental principles of music appreciation, musical composition and musical performance. Students will also acquire an understanding of the historical development of music as well as historical exemplars of musical virtuosity. Coursework may be project- or performance-based, at the discretion of the professor.

AHS109 Korean History [한국사]

The course introduces students to multiple dimensions of the history of Korea, a society which conserves distinctive traditions while also undergoing rapid changes associated with modernization. Students will study historical cases selected from ancient and/or modern Korea, to understand the historical development of Korean society and unique features of its culture. Any relevant theme of historical investigation may be included, such as technology, society, economy, education, gender, politics, medicine, religion, or agriculture.

AHS110 Special Topics in Korean Studies [한국학 특강]

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. Thus, this course is subject to change according to the expertise of the instructor. Course materials are English translations and class discussion will also be conducted in English.

AHS111 Sports and Health [스포츠와 건강]

The course provides instruction in fitness activities for the development of physical and mental health.

AHS112 Gender Partnership in Engineering [성인지와 공학]

This course provides venues for UNIST male and female students to reflect upon gender equality and technoscientific development. Students are encouraged to critically examine the dynamic relationship among science, engineering, organizational culture, diversity, family roles and gender. The class does not aim to impose gender equality in science/engineering as an indisputable norm. Rather, the class aims to stimulate students to think for themselves an important question-- how science/engineering can benefit from gender mainstreaming and vice versa.

▶ Leadership

ULP101, 102, 201, 202 UNIST Leadership I, II, III, IV [리더십프로그램]

In the leadership program, students independently decide activities to do for a semester. While they experience systematic and specialized community life, they can develop qualifications required to be competent leaders such as upright character, cooperative spirit, commitment, etc

School of Mechanical and Nuclear Engineering

1. School Introduction

The School of Mechanical and Nuclear Engineering (MNE) consists of two tracks such as Mechanical Engineering (MEN) and Nuclear Science and Engineering (NSE). The MNE 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. With the state-of-the-art facilities, the combination of traditional engineering and IT, and interdisciplinary approaches, the school concentrates on a variety of research fields, including design, manufacturing, system analysis, energy, nuclear reactions, nuclear fuels and nuclear fuel cycle, nuclear fuel cladding and structural materials, nuclear reactor/system thermal-hydraulics and safety, nuclear radiation, waste disposal, and many nuclear applications. Although the MNE provides two disciplines with students it together emphasizes the creativity and ingenuity of the education.

2. Undergraduate Programs

□ Track Introduction

1) Mechanical Engineering (MEN)

Mechanical 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 engineering have made dramatic advances and high impacts on the global economies and the standard of living. In the track of mechanical engineering, students are educated and trained to learn the underlying principles of mechanical 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, MEMS, biomedical products, controls and mechatronics, acoustics, tribology and so on.

2) Nuclear Science and Engineering (NSE)

The science and engineering principles for nuclear engineering are provided, which are related to using the energy released from nuclear fission or fusion such as nuclear power generation, nuclear propulsion, nuclear radiation applications. Education and research topics include design principles and analyses for nuclear reactions, commercial light water reactors and next-generation nuclear reactors such as liquid-metal-cooled fast reactor and gas-cooled reactor for hydrogen generation, nuclear fusion reactor, fuel cycle and nuclear waste disposal, systems and components for nuclear reactors, reactor theory, nuclear thermo-hydraulics, nuclear fuel and cladding, nuclear structural materials, magnetohydrodynamics, and nuclear radiation applications.

□ Credit Requirement

Track	Required/Elective	Credit(minimum)		
		Interdisciplinary Major		Remark
		1st Track	2nd Track	
Mechanical Engineering	Required	33	9 [1)]	
	Elective	15	9	
Nuclear Science and Engineering	Required	27	12	
	Elective	21	6	

1) Students who choose MEN 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.

□ Fundamental Course for Each track

▶ Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Mechanical and Nuclear Engineering	Mechanical Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
	Nuclear Science and Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1

※ 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**

Course Title	School of Mechanical and Nuclear Engineering	
	MEN	NSE
Calculus I	A	A
Calculus II	R	R
Applied Linear Algebra	A	A
Differential Equations	R	R
Statistics	–	–
General Physics I	R	R
General Physics II	R	R
General Chemistry I	A	A
General Chemistry II	O	O
General Physics Lab I	R	R
General Physics Lab II	R	R
General Chemistry Lab I	O	O
General Chemistry Lab II	O	O

R : Required A : Accepted O : Optional

3. Curriculum

□ Mechanical Engineering (MEN)

Course is		Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	Core requirements	MEN210	Thermodynamics	열역학	3-3-0	
		MEN220	Fluid Mechanics	유체역학	3-3-0	
		MEN230	Solid Mechanics I	고체역학 I	3-3-0	
		MEN231	Solid Mechanics II	고체역학 II	3-3-0	MEN230
		MEN250	Mechanical Drawing and Lab	기계제도 및 실습	3-2-2	
		MEN270	Dynamics	동역학	3-3-0	
		MEN300	Mechanical Engineering Lab	기계공학실험	3-1-4	
		MEN310	Heat Transfer	열전달	3-3-0	MEN210, MEN220
	Selective requirements[2])	MEN211	Applied Thermodynamics	응용열역학	3-3-0	MEN210
		MEN301	Numerical Analysis	수치해석	3-3-0	
		MEN320	Applied Fluid Mechanics	응용유체역학	3-3-0	MEN220
		MEN350	Manufacturing Processes and Lab	기계공작법 및 실습	3-2-2	MEN230
		MEN351	Machine Element Design	기계요소설계	3-3-0	MEN230
		MEN370	Dynamic Systems and Control	시스템제어	3-3-0	
		MEN302	Introduction to Finite Element Method	유한요소법개론	3-3-0	MEN230
		MEN311	Internal Combustion Engine	내연기관	3-3-0	MEN210
		MEN312	Mechatronics and Thermofluid Control	메카트로닉스 및 열유동제어	3-3-0	
		MEN352	Creative Engineering Design I	창의적공학설계 I	3-1-4	
		MEN411	Combustion	연소공학	3-3-0	MEN210, MEN220
		MEN412	Air-Conditioning and Refrigeration	공기조화냉동	3-3-0	MEN210
		MEN431	Introduction to Plastic Deformation	소성학개론	3-3-0	MEN230
		MEN451	Introduction to MEMS	MEMS개론	3-3-0	
		MEN452	Creative Engineering Design II	창의적공학설계 II	3-1-4	MEN352
		MEN453	Computer Aided Engineering	컴퓨터이용공학	3-2-2	
		MEN454	Optimal Design	최적설계	3-2-2	
		MEN455	Multiscale System Design	멀티스케일시스템설계	3-3-0	MEN220
		MEN456	Energy System Design	에너지 시스템설계	3-3-0	MEN210, MEN220

2) 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.

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	MEN457	Introduction to Electric-Electronic Engineering	전기전자공학개론	3-3-0	PHY103
Elective	MEN461	Introduction to Robotics	로봇공학	3-3-0	
Elective	MEN462	Introduction to Biomechanics	생체역학	3-3-0	
Elective	MEN470	Mechanical Vibration	기계진동학	3-3-0	MEN270
Elective	MEN472	Introduction to Sensors	센서개론	3-3-0	
Elective	MEN473	Acoustics	음향학	3-3-0	
Elective	MEN497	Special Topics in Mechanical Engineering Ⅰ	기계공학 특론 Ⅰ	3-3-0	
Elective	MEN498	Special Topics in Mechanical Engineering Ⅱ	기계공학 특론 Ⅱ	3-3-0	
Elective	MEN499	Special Topics in Mechanical Engineering Ⅲ	기계공학 특론 Ⅲ	3-3-0	
Elective	AMS202, NME202	Introduction to Materials Science and Engineering	재료공학개론	3-3-0	
Elective	AMS311	Introduction to Metallic Materials	금속재료개론	3-3-0	
Elective	NME354	Introduction to Semiconductor	반도체개론	3-3-0	
Elective	NME370	Introduction to Polymer Materials	고분자재료개론	3-3-0	
Elective	EE201	Basic Circuit Theory	회로이론	3-3-0	
Elective	EE231	Electromagnetics I	전자기학 I	3-3-0	
Elective	EE301	Microelectronics Ⅰ	전자회로 Ⅰ	3-3-0	EE201
Elective	ESD303	System Control	시스템 제어	3-3-0	
Elective	ESD401	Engineering Design Methods	공학디자인기법	3-3-0	
Elective	DHE201	Design Thinking	디자인적 사고	3-3-0	
Elective	IID201	Design Elements and Principles	디자인요소와 원리	3-2-2	
Elective	ACE331	Transport Phenomena I	전달현상 I	3-3-0	MTH201, ENE212 or CHM231
Elective	BME421	Nano-Bioengineering	나노바이오공학	3-3-0	

▶ Recommended Course Tracks (MEN)

* : Core Required Course ** : Selective Required Course & : Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH201 *MEN210 *MEN230 *MEN250	&MTH103 *MEN220 *MEN231 *MEN250 *MEN270 **MEN211	
3	*MEN310 **MEN301 **MEN320 **MEN350 **MEN351 **MEN370	*MEN300 MEN302 MEN311 MEN312 MEN352	
4	MEN411 MEN412 MEN451 MEN452 MEN455 MEN457 MEN470 MEN497 MEN498 MEN499	MEN431 MEN453 MEN454 MEN456 MEN461 MEN462 MEN472 MEN473 MEN497 MEN498 MEN499	

□ Nuclear Science and Engineering (NSE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite (Remarks)
Required Group	NSE213	Fundamentals of Nuclear Engineering	원자력 공학 개론	3-3-0	
	NSE214	Introduction to Nuclear Fuel Cycle Engineering	핵주기공학 개론	3-3-0	
	NSE221	Nuclear Radiation Engineering & Experiment	원자력방사선공학 및 실험	3-2-2	
	NSE222	Nuclear Materials Engineering & Experiment	원자력재료공학 및 실험	3-2-2	
	NSE311	Introduction to Nuclear Reactor Theory	원자로이론 개론	3-3-0	
	NSE314	Nuclear Engineering Design and Lab I	원자력공학종합설계프로젝트 I	2-0-4	(Capston Design)
	NSE324	Nuclear Engineering Design and Lab II	원자력공학종합설계프로젝트 II	2-0-4	(Capston Design)
	NSE334	Nuclear Engineering Design and Lab III	원자력공학종합설계프로젝트 III	2-0-4	(Capston Design)
	NSE325	Nuclear System Engineering & Experiment	원자로계통공학 및 실험	3-2-2	
	NSE342	Nuclear Reactor Lab	원자로실험	3-0-6	
	NSE480	Introduction to Nuclear Engineering IT	원자력 IT 개론	3-2-2	
	NSE216	Fundamentals of Electromagnetics	전자역학개론	3-3-0	
	NSE326	Nuclear Reactor Numerical Analysis	원자로 수치해석	3-3-0	
	NSE429	Introduction to Nuclear Fuel Engineering	핵연료공학 개론	3-3-0	
	NSE400	Special Topics on Nuclear Engineering and Science I	원자력공학 및 과학 특론 I	3-3-0	
	NSE401	Special Topics on Nuclear Engineering and Science II	원자력공학 및 과학 특론 II	3-3-0	
	NSE402	Special Topics on Nuclear Engineering and Science III	원자력공학 및 과학 특론 III	3-3-0	
	NSE403	Special Topics on Nuclear Engineering and Science IV	원자력공학 및 과학 특론 IV	3-3-0	
	NSE404	Special Topics on Nuclear Engineering and Science V	원자력공학 및 과학 특론 V	3-3-0	
	NSE427	Fundamentals of Nuclear Fusion	핵융합개론	3-3-0	
	ENE212	Physical Chemistry I	물리화학 I	3-3-0	
	ENE322	Instrumental Analysis	기기분석	3-3-0	
	ENE416	Introduction to Nanoscience and Nanotechnology	나노과학 및 기술	3-3-0	
	ENE480	Scientific Expression with IT	공학IT개론	3-2-2	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite (Remarks)
Elective	EE201	Basic Circuit Theory	회로이론	3-3-0	
	EE211	Probability and Introduction to Random Processes	확률과 랜덤프로세스개론	3-3-0	
	CSE232	Discrete Mathematics	이산수학	3-3-0	
	CSE341	Principles of Programming Languages	프로그래밍언어	3-3-0	CSE241
	EE231	Electromagnetics I	전자기학 I	3-3-0	
	PHY204	Electromagnetics II	전자기학 II	3-3-0	PHY203
	PHY301	Quantum Physics I	양자물리학 I	3-3-0	PHY101, PHY102
	PHY303	Thermal and Statistical Physics	열 및 통계물리학	3-3-0	PHY101, PHY102
	PHY315	Solid State Physics	고체물리학	3-3-0	PHY301
	CSE241	Object Oriented Programming	객체 지향 프로그래밍	3-3-0	
	CSE221	Data Structures	데이터구조	3-3-0	CSE241
	CSE331	Introduction to Algorithms	알고리즘	3-3-0	CSE232
	CSE311	Introduction to Operating Systems	운영체제	3-3-0	CSE241, CSE221
	CSE421	Database Systems	데이터베이스 시스템	3-3-0	CSE241, CSE221
	MEN230	Solid Mechanics I	고체역학 I	3-3-0	
	MEN270	Dynamics	동역학	3-3-0	
	MEN210	Thermodynamics	열역학	3-3-0	
	MEN220	Fluid Mechanics	유체역학	3-3-0	
	MEN211	Applied Thermodynamics	응용열역학	3-3-0	MEN210
	MEN301	Numerical Analysis	수치해석	3-3-0	
	MEN310	Heat Transfer	열전달	3-3-0	MEN210, MEN220
	MEN320	Applied Fluid Mechanics	응용유체역학	3-3-0	MEN220
	MEN457	Introduction to Electric-Electronic Engineering	전기전자공학개론	3-3-0	PHY103
	NME202	Introduction to Materials Science and Engineering	재료공학개론	3-3-0	
	NME203	Thermodynamics of Materials	재료열역학	3-3-0	

▶ Recommended Course Tracks (NSE)

* : Required Course, **: Fundamental Course

Year/Sem.	I (Spring)	II (Fall)
2	*NSE213(Fundamentals of Nuclear Engineering) *NSE214(Introduction to Nuclear Fuel Cycle Engineering) **MTH201(Differential Equations) NSE216(Fundamentals of Electromagnetics)	*NSE221(Nuclear Radiation Engineering & Experiment) *NSE222(Nuclear Materials Engineering & Experiment) **MTH103(Applied Linear Algebra)
3	*NSE314(Nuclear Engineering Design and Lab I) *NSE311(Introduction to Nuclear Reactor Theory)	*NSE324(Nuclear Engineering Design and Lab II) *NSE325(Nuclear System Engineering & Experiment) *NSE342(Nuclear Reactor Lab) NSE326(Nuclear Reactor Numerical Analysis)
4		*NSE480(Introduction to Nuclear Engineering IT) NSE427(Fundamentals of Nuclear Fusion) NSE429(Introduction to Nuclear Fuel Engineering)

4. Course Descriptions

▶ Mechanical Engineering (MEN)

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 [고체역학 Ⅰ]

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 MechanicsⅡ [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 [기계공학실험]

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.

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.

MEN311 Internal Combustion Engine [내연기관]

This course covers internal combustion engines such as 4-cycle spark ignition, 4-cycle compression ignition and 2-cycle engines. The topics include fundamentals of thermodynamics in engines, combustion and fuel properties, lubricant and lubrication, heat transfer, friction phenomena, power, efficiency, and emissions.

MEN312 Mechatronics and Thermofluid Control [메카트로닉스 및 열유동제어]

Mechatronics is a fusion course consisting of mechanical engineering and electronics engineering. This course covers how to control mechanical systems by using a microprocessor, electric circuits, OP-AMP, analog circuits, and embedded programming.

MEN320 Applied Fluid Mechanics [응용유체역학]

In this course, based on the topics learned in TFP220, 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.

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.

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.

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.

MEN455 Multiscale System Design [멀티스케일 시스템설계]

This course aims at extending the design principles based on mechanics to designing multi-scale systems. It not only deals with the design principles that are important in macro systems, but it also studies new design principles that are more important in micro-/nano-scales when the ratio of surface to volume decreases. COMSOL Multi-physics, which is a multi-physics modeling and simulation software is also taught to improve the capability of modeling, analyzing and designing multi-scale systems.

MEN456 Energy System Design [에너지 시스템설계]

This course covers optimal design methods for thermal fluids systems consisting of heat exchangers, burners, compressors and pumps, etc. Mathematical formulations for large thermal fluid systems and their solution methods are presented, and several optimization methods for design of the systems are also provided.

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

MEN462 Introduction to Biomechanics [생체역학]

Introduction to biomechanics/Bio-Dynamics/Multibody dynamics/Computational biomechanics/ Human body components biomechanics/Prothetics and protheses/Biomechanics of bone, tendon, ligaments/Advanced topics: Bio-robotics, Rehabilitation engineering/Semester Project

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.

MEN472 Introduction to Sensors [센서개론]

This course introduces principles and characteristics of diverse physical, chemical, and biological sensors and teaches how to convert the measured values from the sensors into meaningful result.

MEN473 Acoustics [음향학]

For the control of sound/noise, study of acoustic terminology, fundamental principles of sound/noise generation, wave propagation, wave equation solution, and instrumentation will be covered in this course.

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.

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.

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.

NSE314 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.

NSE216 Fundamentals of Electromagnetics [전자역학 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.

NSE324 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.

NSE334 Nuclear Engineering Design and Lab III [원자력공학종합설계프로젝트 III]

Advanced design of next-generation nuclear fission and fusion systems requires interdisciplinary knowledges between thermal-hydraulics and materials in terms of safety and economics. Through this course, students learn about how to design and develop nuclear systems based on the above-mentioned major knowledges. Students participate in a comprehensive design and lab activity based on given proposals: Read a proposal for the project; Set up a design goal; Identify design parameters of the system and sketch the performance of the proposed system; Establish quantitative models that show the performance of the system by taking charge of their own learning, and analyze the system performance quantitatively; Identify multiple design constraints in the project, and develop an optimized solution or solutions. The system design project is based on Axiomatic Design principles.

NSE342 Nuclear Reactor Lab [원자로실험]

Experiments are performed for production of radioisotopes, neutron activation analysis, neutron radiography, and fuel burnup measurement utilizing Research Reactor. The reactor system is described with reference to the Kori Units 3 & 4, Westinghouse three- loop pressurized water reactors. Their Final Safety Analysis Report (FSAR) is reviewed to examine the thermal and hydraulic system behavior spanning from an abnormal condi- tion to a loss-of-coolant accident condition. The Compact Nuclear Simulator (CNS) is utilized to study the reactor dynamics involving startup and shutdown practice, to examine the thermal hydraulic behavior of the system after a component malfunction or an operator error, and to compare the results against the licensing calculation reported in the FSAR.

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.

NSE427 Fundamentals of Nuclear Fusion [핵융합개론]

This course focuses on the concept for nuclear fusion. It introduces basic principles and technological issues relevant to plasma and fusion energy generations and their practical uses as a limitless large-scale electric power source in the future. Through this class, students learn plasma, principle of nuclear fusion, the kinds of nuclear fusion, plasma confinement, nuclear fusion device and current status of the nuclear fusion technology.

NSE429 Introduction to Nuclear Fuel Engineering [핵연료공학 개론]

This course covers the basic principles and structures of various nuclear fuels and their actual applications and future fuel developments. The structure, characteristics and materials of different types of fuel wil be introduced and their general irradiation behavior will be discussed. Fuel modelling, testing, design and fabrication will be covered. General in-reactor performance and failure experiences of current generation fuels and future fuel development activities will be introduced.

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)

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)		
		Interdisciplinary Major		Remark
		1st Track	2nd Track	
Environmental Science and Engineering (ESE)	Required	21	9	
	Elective	27	9	
Urban Infrastructure Engineering(UIE)	Required	18	9	
	Elective	30	9	
Disaster Management Engineering (DME)	Required	18	9	
	Elective	30	9	

□ Fundamental Course for each track

▶ Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Urban and Environmental Engineering	Environmental Science and Engineering (ESE)	MTH201	Differential Equations	2-1, 2-2
		MTH103 or MTH211	**Choose One Between:** Applied Linear Algebra, Statistics	2-1, 2-2
	Urban Infrastructure Engineering(UIE)	MTH201	Differential Equations	2-1, 2-2
		MTH103 or MTH211	**Choose One Between:** Applied Linear Algebra, Statistics	2-1, 2-2
	Disaster Management Engineering (DME)	MTH201	Differential Equations	2-1, 2-2
		MTH103 or MTH211	**Choose One Between:** Applied Linear Algebra, Statistics	2-1, 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**

Course Title	School of Urban and Environmental Engineering		
	ESE	UIE	DME
Calculus Ⅰ	A	A	A
Calculus Ⅱ	O	O	O
Applied Linear Algebra	A	A	A
Differential Equations	R	R	R
Statistics	A	A	A
General Physics Ⅰ	A	A	A
General Physics Ⅱ	O	O	O
General Chemistry Ⅰ	A	A	A
General Chemistry Ⅱ	O	O	O
General Physics Lab Ⅰ	O	O	O
General Physics Lab Ⅱ	O	O	O
General Chemistry Lab Ⅰ	O	O	O
General Chemistry Lab Ⅱ	O	O	O

R : Required A : Accepted O : Optional

3. Curriculum

□ Environmental Science and Engineering (ESE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required (1TR: All courses 2TR: Choose 3 courses)	ESE201	Introduction to Environmental Engineering	환경공학개론	3-3-0	
	ESE202	Environmental Chemistry	환경화학	3-3-0	
	ESE203	Global Environment	지구환경	3-3-0	
	ESE204	Water Pollution	수질오염	3-3-0	
	ESE205	Air Pollution	대기오염	3-3-0	
	ESE337	Environmental Thermodynamics	환경열역학	3-3-0	
	ESE333	Introduction to Remote Sensing	원격탐사개론	3-3-0	
	DME321	Numerical Modeling and Analysis	수치모델링 및 분석	3-3-0	
	ESE231	Atmospheric Chemistry	대기화학	3-3-0	
	ESE232	Atmosphere and Ocean Sciences	대기해양과학	3-3-0	
	ESE233	Environmental Geology	환경지질학	3-3-0	
	UIE210	Geographic Information System	지리정보시스템	3-3-0	
	DME201	Introduction to Natural Hazards	자연재해개론	3-3-0	
	ACE331	Transport Phenomena	전달현상 I	3-3-0	MTH201, ENE212 or CHM231
	BIO331	Microbiology	미생물학	3-3-0	
	CHM211	Organic Chemistry I	유기화학 I	3-3-0	
	CHM212	Organic Chemistry II	유기화학 II	3-3-0	
	CHM231	Physical Chemistry I	물리화학 I	3-3-0	
	CHM232	Physical Chemistry II	물리화학 II	3-3-0	
	MEN220	Fluid Mechanics	유체역학	3-3-0	
	ESE311	Water Treatment Engineering	수처리공학	3-3-0	
	ESE312	Soil Pollution	토양오염	3-3-0	
	ESE313	Aquatic Chemistry Laboratory	수질화학실험	3-2-2	
	ESE331	Analysis of Pollutants	오염물질분석/실험	3-2-2	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	ESE332	Hydrology	수문학	3-3-0	
	ESE334	Atmospheric Dynamics	대기역학	3-3-0	
	ESE335	Biogeochemistry	생지화학	3-3-0	
	ESE336	Environmental Impact Assessment	환경영향평가	3-3-0	
	DME311	Probability Concepts in Engineering	공학확률	3-3-0	
	ACE311	Chemical Reaction Engineering	반응공학	3-3-0	
	ACE332	Transport Phenomena II	전달현상 II	3-3-0	
	CHM391	Instrumental Analysis	기기분석	3-3-0	
	ESE411	Water and Wastewater Engineering	상하수도공학	3-3-0	
	ESE412	Environmental Remediation	환경복원	3-3-0	
	ESE413	Wastes Management	폐기물처리/재활용	3-3-0	
	ESE414	Environmental Bioprocess	환경생물공정	3-3-0	
	ESE415	Environmental Toxicology	환경독성학	3-3-0	
	ESE416	Hydraulics	수리학	3-3-0	
	ESE421	Special Topics in Environmental Engineering I	환경공학특론 I	3-3-0	
	ESE422	Special Topics in Environmental Engineering II	환경공학특론 II	3-3-0	
	ESE423	Special Topics in Environmental Engineering III	환경공학특론 III	3-3-0	
	ESE431	Climate Dynamics	기후역학	3-3-0	
	ESE432	Earth Environment Numerical Analysis	지구환경전산실습	3-2-2	
	ESE433	Satellite Remote Sensing	위성원격탐사	3-3-0	
	ESE434	Climate Change Engineering	기후변화공학	3-3-0	
	ESE435	GIS-Based Modeling	GIS 기반 모델링	3-3-0	
	ESE436	Statistics in Earth and Environmental Sciences	지구환경통계학	3-3-0	
	ESE441	Special Topics in Earth Science I	지구환경특론 I	3-3-0	
	ESE442	Special Topics in Earth Science II	지구환경특론 II	3-3-0	
	ESE443	Special Topics in Earth Science III	지구환경특론 III	3-3-0	
	DME421	Weather Analysis and Prediction	날씨 분석 및 예측	3-3-0	

▶ Recommanded Course Tracks (ESE)

* : Required Course, &: Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH201 &MTH103 *ESE201 *ESE202 *ESE203 *ESE205 DME201 CHM211 CHM231	&MTH201 &MTH103 &MTH211 *ESE204 ESE231 ESE232 ESE233 UIE210 CHM212 CHM232 MEN220	Required One of Either MTH103 or MTH211 2TR: Choose Three in Required Courses
3	ESE335 ESE336 *ESE337 ACE311 ACE331 BIO331 CHM391	ESE311 ESE312 ESE313 ESE331 ESE332 *ESE333 ESE334 DME311 DME321 ACE332	
4	ESE411 ESE412 ESE416 ESE421 ESE422 ESE431 ESE432 ESE435 ESE441 ESE442	ESE413 ESE414 ESE415 ESE423 ESE433 ESE434 ESE436 ESE443 DME421	

□ Urban Infrastructure Engineering (UIE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	UIE201	Introduction to Civil Engineering	건설공학개론	3-3-0	
	UIE203	Introduction to Urban Planning	도시계획개론	3-3-0	
	UIE204	Mechanics of Materials	재료역학	3-3-0	UIE201
	UIE210	Geographic Information System	지리정보시스템	3-3-0	
1TR: R 2TR: E	UIE303	Structural Analysis	구조역학	3-3-0	UIE204
	DME311	Probability Concepts in Engineering	공학확률	3-3-0	
Elective	DME321	Numerical Modeling and Analysis	수치모델링 및 분석	3-3-0	
	UIE202	Sustainable Design	환경설계론	3-1-4	
	UIE205	Construction Materials	건설재료공학	3-3-0	
	UIE207	Urban and Regional Development	도시 및 지역개발	3-3-0	
	ESE201	Introduction to Environmental Engineering	환경공학개론	3-3-0	
	MGT211	Microeconomics	미시경제학	3-3-0	MGT106
	MEN220	Fluid Mechanics	유체역학	3-3-0	
	UIE301	Urban Transportation Planning	교통계획	3-3-0	
	UIE304	Matrix Structural Analysis	매트릭스구조해석	3-3-0	UIE303
	UIE305	Soil Mechanics	토질역학	3-3-0	
	UIE306	Concrete Structures	콘크리트구조공학	3-3-0	UIE204
	UIE307	Properties of Concrete	콘크리트재료공학	3-2-2	
	UIE308	Structural Engineering Lab	구조공학실험	3-1-4	UIE204
	ESE332	Hydrology	수문학	3-3-0	
	ESE333	Introduction to Remote Sensing	원격탐사개론	3-3-0	
	DME331	Disaster Management	재난관리	3-3-0	
	DME332	Disaster Analysis	재난분석	3-3-0	
	MGT315	Econometrics	계량경제학	3-3-0	MGT211, MTH211
	UIE401	Steel Structures	강구조공학	3-3-0	UIE204
	UIE402	Design of Structural Systems	구조시스템설계	3-3-0	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
	UIE403	Foundation Engineering	기초공학	3-3-0	
	UIE404	Infrastructure Engineering	사회기반시설공학	3-3-0	
	UIE405	Urban Design	도시설계	3-3-0	
	UIE406	Development Finance	도시개발재무	3-3-0	
	UIE408	Introduction to Structural Dynamics	구조동역학개론	3-3-0	
	UIE410	Special Topics in Urban Infrastructure Engineering Ⅰ	도시건설공학특론 Ⅰ	3-3-0	
	UIE411	Special Topics in Urban Infrastructure Engineering Ⅱ	도시건설공학특론 Ⅱ	3-3-0	
	UIE412	Special Topics in Urban Infrastructure Engineering Ⅲ	도시건설공학특론 Ⅲ	3-3-0	
	ESE411	Water and Wastewater Engineering	상하수도공학	3-3-0	
	ESE416	Hydraulics	수리학	3-3-0	
	ESE433	Satellite Remote Sensing	위성원격탐사	3-3-0	
	ESE435	GIS-Based Modeling	GIS 기반 모델링	3-3-0	
	DME432	Vulnerability and Capacity Analysis	재해취약성 및 수용력분석	3-3-0	UIE210

▶ Recommanded Course Tracks (UIE)

* : Required Course, ** : Required only for 1st track, &: Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	*UIE201 UIE202 *UIE203 &MTH201 &MTH103	*UIE204 UIE205 UIE207 *UIE210 MGT211 MEN220 &MTH201 &MTH103 &MTH211	Required One of Either MTH103 or MTH211 2TR: Required 1) and 2) 1) Both UIE201 and UIE203 2) One of Either UIE204 or UIE210
3	**UIE303 UIE305 UIE306 UIE308 DME331 DME332	UIE301 UIE304 UIE307 DME321 **DME311 ESE332 ESE333	
4	UIE401 UIE403 UIE404 UIE405 UIE410 ESE411 ESE416	UIE402 UIE406 UIE408 UIE411 UIE412 DME432	

☐ Disaster Management Engineering (DME)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	DME201	Introduction to Natural Hazards	자연재해개론	3-3-0	
	DME311	Probability Concepts in Engineering	공학확률	3-3-0	
	DME331	Disaster Management	재난관리	3-3-0	
1TR: R 2TR: E	ESE201	Introduction to Environmental Engineering	환경공학개론	3-3-0	
	UIE201	Introduction to Civil Engineering	건설공학개론	3-3-0	
	UIE203	Introduction to Urban Planning	도시계획개론	3-3-0	
	DME202	Man-made Disasters	인적재해	3-3-0	
	ESE203	Global Environment	지구환경	3-3-0	
	ESE204	Water Pollution	수질오염	3-3-0	
	ESE205	Air Pollution	대기오염	3-3-0	
	UIE204	Mechanics of Materials	재료역학	3-3-0	UIE201
	UIE205	Construction Materials	건설재료공학	3-3-0	
	UIE210	Geographic Information System	지리정보시스템	3-3-0	
	MEN220	Fluid Mechanics	유체역학	3-3-0	
	DME321	Numerical Modeling and Analysis	수치모델링 및 분석	3-3-0	
	DME332	Disaster Analysis	재난분석	3-3-0	
	DME341	Water Resources Engineering	수자원공학	3-3-0	
	ESE312	Soil Pollution	토양오염	3-3-0	
	ESE332	Hydrology	수문학	3-3-0	
	ESE333	Introduction to Remote Sensing	원격탐사개론	3-3-0	
	ESE334	Atmospheric Dynamics	대기역학	3-3-0	
	ESE336	Environmental Impact Assessment	환경영향평가	3-3-0	
	UIE301	Urban Transportation Planning	교통계획	3-3-0	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	UIE303	Structural Analysis	구조역학	3-3-0	UIE204
	UIE304	Matrix Structural Analysis	매트릭스구조해석	3-3-0	UIE303
	UIE305	Soil Mechanics	토질역학	3-3-0	
	UIE306	Concrete Structures	콘크리트구조공학	3-3-0	UIE204
	UIE307	Properties of Concrete	콘크리트재료공학	3-2-2	
	UIE308	Structural Engineering Lab	구조공학실험	3-1-4	UIE204
	DME411	Hazard Analysis for System Safety	재해분석과 시스템안전성	3-3-0	
	DME421	Weather Analysis and Prediction	날씨 분석 및 예측	3-3-0	
	DME431	Economics of Disaster	재난경제학	3-3-0	
	DME432	Vulnerability and Capacity Analysis	재해취약성 및 수용력분석	3-3-0	UIE210
	DME491	Special Topics in Disaster Management Engineering I	재난관리공학특론 I	3-3-0	
	DME492	Special Topics in Disaster Management Engineering II	재난관리공학특론 II	3-3-0	
	DME493	Special Topics in Disaster Management Engineering III	재난관리공학특론 III	3-3-0	
	ESE412	Environmental Remediation	환경복원	3-3-0	
	ESE416	Hydraulics	수리학	3-3-0	
	ESE433	Satellite Remote Sensing	위성원격탐사	3-3-0	
	ESE435	GIS-Based Modeling	GIS 기반 모델링	3-3-0	
	UIE401	Steel Structures	강구조공학	3-3-0	UIE204
	UIE403	Foundation Engineering	기초공학	3-3-0	
	UIE404	Infrastructure Engineering	사회기반시설공학	3-3-0	
	UIE408	Introduction to Structural Dynamics	구조동역학개론	3-3-0	

▶ Recommanded Course Tracks (DME)

*: Required Course, **: Required only for 1st track, &: Required Math, @: Strongly Recommended

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH201 &MTH103 *DME201 **ESE201 ESE203 ESE205 **UIE201 **UIE203	&MTH201 &MTH103 &MTH211 @DME202 ESE204 @UIE204 UIE205 @UIE210 MEN220	Required One of Either MTH103 or MTH211
3	*DME331 @DME332 @DME341 ESE336 @UIE303 UIE305 UIE306 UIE308	*DME311 DME321 ESE312 ESE332 @ESE333 ESE334 UIE301 UIE304 UIE307	
4	@DME411 DME491 DME492 ESE412 ESE416 ESE435 UIE401 UIE403 UIE404	@DME421 @DME431 @DME432 DME493 ESE433 @UIE408	

- The classes with '*' are required for both 1st track and 2nd track.
- The classes with '**' are required only for 1st track.
- The classes with '@' are strongly recommended to take, but not required courses for graduation.

4. 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 Global Environment [지구환경]

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.

ESE231 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.

ESE232 Atmosphere and Ocean [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 Environmental Geology [환경지질학]

This course offers an introduction to geological processes and materials, and how they affect people and the environment. Specific topics include earthquakes, volcanism, mass wasting, floods, coastal hazards, and climatic change. Optional topics may include such items as energy and water resources, subsidence, and waste disposal.

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.

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.

ESE332 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.

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.

ESE336 Environmental Impact Assessment [환경영향평가]

An environmental impact assessment (EIA) is a tool to evaluate the impact of urban development on the surrounding environment. EIA can be directly used for decision making, suggesting a modified development plan, or its eventual cancellation. In this course, practical methods for EIA will be studied.

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.

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 Wastes 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.

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.

ESE433 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.

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.

ESE441 Special Topics in Earth Science I [지구환경특론I]

This course introduces new research topics in earth science.

ESE442 Special Topics in Earth Science II [지구환경특론II]

This course introduces new research topics in earth science.

ESE443 Special Topics in Earth Science III [지구환경특론III]

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.

UIE205 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.

UIE207 Urban and Regional Development [도시 및 지역개발]

This course introduces fundamental concepts and theories applied to local economic development including growth, trade, product-cycle, flexible specialization, and entrepreneurship theories.

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. Students will learn the physical properties of soils and the behavior of soils under various types of forces. This course primarily covers classification of soil, compaction, permeability and seepage, effective stress, compressibility, and shear strength of soil.

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.

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 is concerned with not only the design of foundations for super structures but also the design of non-foundation systems such as retaining walls, bulkheads, cofferdams, tunnels, and earth dams. The required techniques for the design will be also discussed, which includes site investigations and ground improvements.

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.

UIE406 Development Finance [도시개발 재무]

Community development of financial institutions and loan funds for local asset building and wealth creation, investment analysis to structure and finance local projects, and real estate and business development cases will be introduced in this course.

UIE408 Introduction to Structural Dynamics [구조동역학개론]

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.

UIE410 Special Topics in Urban infrastructure Engineering I [도시건설공학특론 I]

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.

UIE411 Special Topics in Urban Infrastructure Engineering II [도시건설공학특론 II]

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.

UIE412 Special Topics in Urban Infrastructure Engineering III [도시건설공학특론 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.

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 Analysis [재난분석]

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.

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.

DME431 Economics of Disaster [재난경제학]

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

The School of Design and Human Engineering focuses on theoretical and practical studies on innovative design creation by investigating all aspects of product and product-service system development including needs finding, strategy establishment, planning, conceptualization, analysis of human capabilities and limitations, system integration, manufacturing and business implementation. DHE emphasizes synthetic thought processes that require interdisciplinary and convergent knowledge from (but not limited to) art, engineering, humanities and science. DHE provides two specialized tracks - Industrial Design and Human and Systems Engineering. A wide range of curricula will help students become global experts making innovations with creativity in diverse areas across design and engineering.

2. Undergraduate Programs

□ Track Introduction

1) Industrial Design (ID)

The Industrial Design track is designed 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 and System Engineering (HSE)

In the Human & Systems Engineering track, students will learn basic and applied knowledge regarding the functions of the human physical, cognitive and affective systems and on topics such as general ergonomics, HCI (human computer interaction) and engineering design. They will also become familiar

with the tools necessary for optimal product design and engineering. This track will equip students with systems thinking and problem solving capabilities as well as a holistic understanding of the product development process including planning, designing, engineering, testing/evaluation, and managing.
More specifically, Human Factors Engineering is the branch of science that applies what is known about human behavior, mental (cognitive/affective) processes, and anatomy and physiology to the systemic design development, and evaluation of work methods, environments, technologies, and products/systems. Systems Engineering provides methods 1) to transform elemental technologies from mechanics and electronics into practical products, 2) to convert scientific principles and engineering technologies into manufacturing-related information, and 3) to construct manufacturing systems.

□ Credit Requirement

Classification			DHE Required (# of courses)	Track Required (# of courses)	Track Elective (# of courses)	Credit (minimum)
1st track(DHE) / 2nd track(DHE)	1st track	ID / HSE	12 (4)	21 (7)	15 (5)	48 (16)
	2nd track	HSE / ID		15 (5)	3 (1)	18 (6)
1st track(DHE) / 2nd track (other school)	1st track	ID / HSE	12 (4)	21 (7)	15 (5)	48 (16)
	2nd track (other school's tracks)			in conformity with the 2nd track's credit requirement		18
1st track (other school) / 2nd track(DHE)	1st track (other school's tracks)			in conformity with the 1st track's credit requirement		48
	2nd track	ID / HSE		15 (5)	3 (1)	18 (6)

		Credits	# of courses						
			Total	2-1	2-2	3-1	3-2	4-1	4-2
ID/HSE 1st track	Total	48	16	2	3	3	3	3	2
	DHE Required	12	4	1	-	-	1	1	1
	Track Required	21	7	1	2	2	1	1	
	Elective	15	5		1	1	1	1	1
ID/HSE 2nd track	Total	18	6	1	1	1	1	1	1
	Track Required	15	5	1	1	1	1	1	
	Elective	3	1						1

Fundamental Course for Each track

Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Design & Human Engineering	Industrial Design	MTH103	Applied Linear Algebra	2–1
		MTH211	Statistics	2–2
	Human & Systems Engineering	MTH103	Applied Linear Algebra	2–1
		MTH211	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.

Required IT Courses

School	Programming	Practical IT	Designated course by the school
School of Design & Human Engineering	Engineering Programming I	Engineering Programming II	Interactive Technology Computational Tools for Engineers : choose 1

※ Complete based on 1T(It applied to the students who entered before the year of 2014)

Fundamentals required to Business field students when they choose Engineering field tracks

Course Title	School of Design & Human Engineering	
	ID	HSE
Calculus I	A	A
Calculus II	O	R
Applied Linear Algebra	A	A
Differential Equations	O	O
Statistics	A	A
General Physics I	A	A
General Physics II	O	O
General Chemistry I	A	A
General Chemistry II	O	O
General Physics Lab I	O	O
General Physics Lab II	O	O
General Chemistry Lab I	O	O
General Physics Lab II	O	O

R : Required A : Accepted O : Optional

3. Curriculum

□ Industrial Design (ID)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
DHE Required	DHE201	Design Thinking	디자인적 사고	3-3-0	
	DHE302	DHE Research Methods	DHE 연구 방법	3-2-2	
	DHE401	Creative Design 1	창의디자인 1	3-2-2	
	DHE402	Creative Design 2	창의디자인 2	3-2-2	
ID Required	IID201	Design Elements and Principles	디자인요소와 원리	3-2-2	
	IID202	Product Design Fundamentals	제품디자인기초	3-2-2	IID201
	IID204	Design Knowledge and Skill	디자인 지식과 기술	3-2-2	
	IID301	Product Design I	제품디자인 I	3-2-2	IID202
	IID302	Product Design II	제품디자인 II	3-2-2	IID301
	IID303	3D CAD & Prototyping	3D CAD와 프로토타이핑	3-2-2	
	IID401	Product Service System Design	제품서비스시스템디자인	3-2-2	
ID Elective	IID206	Design Sketching & Visualization	디자인 스케치와 시각화	3-2-2	
	IID304	Interactive Technology	인터랙티브 기술	3-2-2	
	IID402	Design Communication	디자인 커뮤니케이션	3-2-2	
	AHE201	Introduction to Human Factors Engineering	인간공학개론	3-3-0	
	AHE202	Cognitive Ergonomics	인지 인간공학	3-3-0	
	AHE203	Physical Ergonomics	인체인간공학	3-3-0	
	AHE301	Experimental Design	실험계획법	3-3-0	
	AHE302	Perception	인간지각	3-3-0	
	AHE311	Usability Engineering	사용성공학	3-3-0	
	AHE402	Affective Engineering	감성공학	3-3-0	
	AHE411	Safety Engineering	안전공학	3-3-0	
	AHE412	Brain-Computer Interaction	뇌 컴퓨터 상호작용	3-3-0	
	ESD201	Engineering Mechanics I	기초역학 I	3-3-0	
	ESD202	Basic Circuit Theory & Lab	기초회로이론 및 실습	3-2-2	
	ESD204	Computational Tools for Engineers	공학전산기법	3-3-0	
	ESD302	Manufacturing System Design & Simulation	생산시스템설계 및 시뮬레이션	3-2-2	
	ESD303	System Control	시스템 제어	3-3-0	
	ESD401	Engineering Design Methods	공학디자인기법	3-3-0	
	DHE312	High Touch Design	하이터치 디자인	3-2-2	
	DHE313	Color Science & Design	색채과학과 디자인	3-2-2	
	IID410	Special Topics in IID I	통합산업디자인특론 I	3-3-0	
	IID420	Special Topics in IID II	통합산업디자인특론 II	3-3-0	
	IID430	Special Topics in IID III	통합산업디자인특론 III	3-3-0	

▶ Recommended Course Tracks (ID)

ID Major

Year/ Sem.	Course is	I (Spring)	II (Fall)
2	Required	DHE201 IID201	IID202 IID204
	Elective	_	elective1
3	Required	IID301 IID303	DHE302 IID302
	Elective	elective2	elective3
4	Required	DHE401 IID401	DHE402
	Elective	elective4	elective5

ID Minor

Year/ Sem.	Course is	I (Spring)	II (Fall)
2	Required	IID201	IID202
	Elective	_	_
3	Required	IID303	IID302
	Elective	_	_
4	Required	IID401	_
	Elective	_	elective1

☐ Human and Systems Engineering (HSE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Remark
DHE Required	DHE201	Design Thinking	디자인적 사고	3-3-0	AHE/ESD
	DHE302	DHE Research Methods	DHE 연구 방법	3-2-2	AHE/ESD
	DHE401	Creative Design I	창의디자인 I	3-2-2	AHE/ESD
	DHE402	Creative Design II	창의디자인 II	3-2-2	AHE/ESD
HSE Required	AHE201	Introduction to Human Factors Engineering	인간공학개론	3-3-0	AHE
	AHE202	Cognitive Ergonomics	인지 인간공학	3-3-0	AHE
	AHE203	Physical Ergonomics	인체인간공학	3-3-0	AHE
	AHE301	Experimental Design	실험계획법	3-3-0	AHE
	AHE302	Perception	인간지각	3-3-0	AHE
	AHE311	Usability Engineering	사용성공학	3-3-0	AHE
	AHE411	Safety Engineering	안전공학	3-3-0	AHE
	ESD201	Engineering Mechanics I	기초역학 I	3-3-0	ESD
	ESD202	Basic Circuit Theory & Lab	기초회로이론 및 실습	3-2-2	ESD
	ESD204	Computational Tools for Engineers	공학전산기법	3-3-0	ESD
	ESD301	Engineering Drawing and Analysis	기계제도 및 해석	3-2-2	ESD
	ESD302	Manufacturing System Design & Simulation	생산시스템설계 및 시뮬레이션	3-2-2	ESD
	ESD303	System Control	시스템 제어	3-3-0	ESD
	ESD401	Engineering Design Methods	공학디자인기법	3-3-0	ESD

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Remark
HSE Elective	IID303	3D CAD & Prototyping	3D CAD와 프로토타이핑	3-2-2	ESD
	IID304	Interactive Technology	인터랙티브 기술	3-2-2	ESD
	AHE312	Work Measurement Methods	작업측정 및 방법	3-3-0	AHE
	AHE314	Advanced Topics in ACE (Affect, Cognition and Ergonomics)	감성, 인지, 인간공학 고등주제	3-3-0	AHE
	AHE402	Affective Engineering	감성공학	3-3-0	AHE
	AHE412	Brain-Computer Interaction	뇌 컴퓨터 상호작용	3-3-0	AHE
	AHE410	Special Topics in AHE I	감성및인간공학 특론 I	3-3-0	AHE
	AHE420	Special Topics in AHE II	감성및인간공학 특론 II	3-3-0	AHE
	AHE430	Special Topics in AHE III	감성및인간공학 특론 III	3-3-0	AHE
	ESD206	Engineering Mechanics II	기초역학 II	3-3-0	ESD
	ESD403	Reliability Engineering	신뢰성공학	3-3-0	ESD
	ESD410	Special Topics in ESD I	공학및시스템디자인 특론 I	3-3-0	ESD
	ESD420	Special Topics in ESD II	공학및시스템디자인 특론 II	3-3-0	ESD
	ESD430	Special Topics in ESD III	공학및시스템디자인 특론 III	3-3-0	ESD
	DHE312	High Touch Design	하이터치 디자인	3-2-2	AHE/ESD
	DHE313	Color Science & Design	색채과학과 디자인	3-2-2	AHE
	MEN350	Manufacturing Processes and Lab	기계공작법 및 실습	3-2-2	ESD

▶ Recommended Course Tracks (HSE)

HSE Major

Year/ Sem.	Course is	I (Spring)	II (Fall)
2	Required	DHE201 AHE201 ESD201 ESD204	AHE202 AHE203 ESD202
	Elective	-	elective1
3	Required	AHE301 AHE311 ESD301	DHE302 AHE302 ESD302 ESD303
	Elective	elective2	elective3
4	Required	DHE401 AHE411 ESD401	DHE402
	Elective	elective4	elective5

HSE Minor

Year/ Sem.	Course is	I (Spring)	II (Fall)
2	Required	AHE201 ESD201 ESD204	AHE202 or AHE203
	Elective	-	-
3	Required	AHE301	AHE302 ESD302 ESD303
	Elective	-	-
4	Required	AHE411 ESD401	-
	Elective	-	elective1

※ AHE-coded courses are recommended for those who want to major in Affective and Human Factors Engineering and ESD-coded courses are recommended for those who want to major in Engineering and Systems Design.

4. Course Descriptions

▶ Industrial Design (ID)

DHE201 Design Thinking [디자인적 사고]

This course is an introductory course in 'Design' and 'Design Thinking' conducted through team teaching. Three disciplines that take an important role in the 'Product Development Process' collaborate to run this course. Students will learn various problem seeking and problem solving methods as well as gain an appreciation for the impact of each discipline on the product development process. The course will be delivered by a combination of lectures and studio time. Assessment will be based upon a problem solving project and poster presentation.

DHE302 DHE Research Methods DHE [연구 방법]

This course provides an overview of applied research methods in the areas of design, human factors and engineering/manufacturing. These three disciplines contribute to provide an understanding of the research methods, strategies and concepts employed across each discipline. Students will conduct a research project involving the practical application of the knowledge they have gained for assessment.

DHE401 Creative Design I [창의 디자인 I]

This course involves student teams composed of members from design, human factors and engineering conducting the first stage of a substantial product development process. During the course students are required to identify an area of study, conduct interdisciplinary research and conceive and propose a novel idea or design concept for this space. Final outcomes will include a report and presentation describing the problem area, research conducted and final design concepts.

DHE402 Creative Design II [창의 디자인 II]

This course uses, as a starting point, interdisciplinary team work undertaken during Creative Design I (DHE401). During the course students continue to develop and refine their ideas through the application of knowledge and skills acquired during their undergraduate degree. The scope of final outcomes may include, but not be limited to, the fabrication of functional prototypes; design specifications; patent applications; proposed business models, systems and reports. Finally, student teams will present their work as prototypes, visual representations, posters and any other relevant medium at a terminal degree exhibition open to industry and the public.

IID201 Design Elements and Principles [디자인 요소와 원리]

This course is a basic design course which aims to cultivate creative presentation techniques. Basic elements and principles of 2D and 3D design are taught through lectures and studio practice. This will then provide students with a more developed understanding of the relationship between visual and functional elements of design. The course will also cover the principle of esthetic harmony.

IID202 Product Design Fundamentals [제품디자인 기초]

This is an introductory course in product design. Students will develop a greater understanding of

3D form and aesthetic both through lectures and discussion of key concepts and their application in series of design tasks and short projects. Through projects designing low-tech 3D products and artifacts, students learn skills ranging from solving observed design problems to constructing prototypes and mockups to communicate design intent.

IID204 Design Knowledge and Skill [디자인 지식과 기술]

A comprehensive prototyping approach is critical to making informed design decisions and is a strategic part of an industrial designer's toolkit. This course explains how models and prototypes of various levels of fidelity are used to understand design problems, explore solutions, investigate human interactions and communicate design intent to others. Students will learn effective prototyping skills, methods and strategies using various workshop machines and digital technologies to realize and communicate their design intentions.

IID206 Design Sketching & Visualization [디자인 스케치와 시각화]

This course focuses on the core design ability of sketching and visualization 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. The course will provide students with improved sketching abilities and a more holistic approach to and understanding of sketching as a means to support design practice.

IID301 Product Design I [제품 디자인 I]

This course is a practical instruction in product design focusing on product innovation, production processes and techniques, characteristics of materials, and some of the key concepts and principles that underpin product design practice. The course aims to develop students' capacity to design products according to the system of mass production through practicing the creation of product concepts and the improvement of current designs.

IID302 Product Design II [제품 디자인 II]

This course is designed with a focus on market research related to product design such as product life cycle, classification of markets, and the consumer's motivation to purchase. This course cultivates students' ability to satisfy consumer needs through survey methods, gathering statistics, cultural anthropological approaching and design based scenarios.

IID303 3D CAD & Prototyping [3D CAD와 프로토타이핑]

This course deals with the Virtual Product Design Process using 3D Computer Aided Design methods. Students learn various virtual methods related to product design from transforming sketches on paper into 3D solid data, elaborated modeling, design engineering and visualization, to workable prototyping methods using NC or RP technologies. During the course students will conduct a small project using a virtual product design process.

IID304 Interactive technology [인터랙티브 기술]

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.

IID401 Product Service System Design [제품서비스 시스템디자인]

The objective of this course is to investigate the integrated concept of design products and their systems. Emphasis is given to applying innovative and systematic approaches to complex design problems. As a total design, it will focus on not only hardware but also software to create a holistic design solution for product systems. The course will emphasize team work and collaborative learning to solve theoretical and practical design issues.

IID402 Design Communication [디자인 커뮤니케이션]

This course addresses the fundamental principles of design theory and communication. Emphasis is given to portfolio design and self promotion through the use of various media. The course also aims to develop a greater understanding of the relationship between communication and design practice within 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.

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.

AHE201 Introduction to Human Factors Engineering [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.

AHE202 Cognitive Ergonomics [인지 인간공학]

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.

AHE203 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.

AHE301 Experimental Design [실험 계획법]

The course describes procedures for conducting and analyzing human factors and ergonomics studies. It includes the fundamentals of research, experimental design alternatives, fitting and testing statistical models, and data interpretation and presentation. In terms of statistics, the primary focus is on linear regression (simple and multiple) and analysis of variance (single and multiple factor).

AHE302 Perception [인간지각]

This course focuses on the philosophy, physiology and psychology of the bodily senses and the methods used to study them. It will include discussions of low-level sensory pathways, higher-level perceptual processes and touch on relevant aspects of cognition. A strong focus will be on the sense of vision, but material covering other senses (notably hearing and touch) will also be included.

AHE311 Usability Engineering [사용성 공학]

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 measures 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 a series of class projects.

AHE402 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.

AHE411 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.

AHE412 Brain-Computer Interaction [뇌 컴퓨터 상호작용]

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

ESD201 Engineering Mechanics I [기초역학 I]

This course studies the essential and fundamental concepts of engineering mechanics, including solid mechanics, dynamics, fluid dynamics, and thermodynamics. In this course, students are expected to understand basic knowledge of system physics in order to analyze and model mechanical systems.

ESD202 Basic Circuit Theory & Lab [기초회로이론 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.

ESD204 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.

ESD302 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.

ESD303 System Control [시스템 제어]

This course aims to introduce students to the fundamental principles of system modeling and its control. Students will study how to model the dynamics of mechanicals, electrical and hybrid systems. The topics include control system modeling, time response and frequency response analysis, classic control theory, and state space representation. Projects with MATLAB and LabView will be conducted during the course. Engineering Mechanics I and Basic Circuit Theory & Lab are recommended prerequisites for this course.

ESD401 Engineering Design Methods [공학디자인기법]

This course examines the essential engineering design methods for each step of the design process. Quality Function Deployment (QFD), functional flow analysis and morphological analysis will be studied for the product specification and the generation phases of design alternatives, whilst various optimization techniques such as interval arithmetic, constraint satisfaction & propagation algorithms and Multiple Criteria Decision Analysis (MCDA) will be discussed for the selection phase of design alternatives. Theoretical exercises with case studies will complement the course.

DHE312 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.

DHE313 Color Science & Design [색채과학과 디자인]

In this course, students will learn color as a science and also as an art. Human visual system, color measurement systems, color order systems and psychophysical experimental methods will be taught to understand color as a science while various color combinations will be studied and applied to design works to understand color as an art. Students will conduct their projects focusing on their own interests; science or art.

▶ Human & Systems Engineering track (HSE)

DHE201 Design Thinking [디자인적 사고]

This course is an introductory course in 'Design' and 'Design Thinking' conducted through team teaching. Three disciplines that take an important role in the 'Product Development Process' collaborate to run this course. Students will learn various problem seeking and problem solving methods as well as gain an appreciation for the impact of each discipline on the product development process. The course will be delivered by a combination of lectures and studio time. Assessment will be based upon a problem solving project and poster presentation.

DHE302 DHE Research Methods DHE [연구 방법]

This course provides an overview of applied research methods in the areas of design, human factors and engineering/manufacturing. These three disciplines contribute to provide an understanding of the research methods, strategies and concepts employed across each discipline. Students will conduct a research project involving the practical application of the knowledge they have gained for assessment.

DHE401 Creative Design I [창의 디자인 I]

This course involves student teams composed of members from design, human factors and engineering conducting the first stage of a substantial product development process. During the course students are required to identify an area of study, conduct interdisciplinary research and conceive and propose a novel idea or design concept for this space. Final outcomes will include a report and presentation describing the problem area, research conducted and final design concepts.

DHE402 Creative Design II [창의 디자인 II]

This course uses, as a starting point, interdisciplinary team work undertaken during Creative Design I (DHE401). During the course students continue to develop and refine their ideas through the application of knowledge and skills acquired during their undergraduate degree. The scope of final outcomes may include, but not be limited to, the fabrication of functional prototypes; design specifications; patent applications; proposed business models, systems and reports. Finally, student teams will present their work as prototypes, visual representations, posters and any other relevant medium at a terminal degree exhibition open to industry and the public.

AHE201 Introduction to Human Factors Engineering [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.

AHE202 Cognitive Ergonomics [인지 인간공학]

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.

AHE203 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.

AHE301 Experimental Design [실험 계획법]

The course describes procedures for conducting and analyzing human factors and ergonomics studies. It includes the fundamentals of research, experimental design alternatives, fitting and testing statistical models, and data interpretation and presentation. In terms of statistics, the primary focus is on linear regression (simple and multiple) and analysis of variance (single and multiple factor).

AHE302 Perception [인간지각]

This course focuses on the philosophy, physiology and psychology of the bodily senses and the methods used to study them. It will include discussions of low-level sensory pathways, higher-level perceptual processes and touch on relevant aspects of cognition. A strong focus will be on the sense of vision, but material covering other senses (notably hearing and touch) will also be included.

AHE311 Usability Engineering [사용성 공학]

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 measures 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 a series of class projects.

AHE312 Work Measurement & Methods [작업 측정 및 방법]

This course surveys methods for assessing and improving the performance of individuals and groups in organizations. Topics studied include basic industrial engineering tools, work analysis, data acquisition and applications, performance evaluation and appraisal, and work measurement procedures.

AHE314 Advanced Topics in ACE (Affect, Cognition and Ergonomics) [감성, 인지, 인간공학 고등주제]

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.

AHE402 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.

AHE411 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.

AHE412 Brain-Computer Interaction [뇌 컴퓨터 상호작용]

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

AHE410,420,430 Special Topics in AHE I, II, III [감성및인간공학 특론 I, II, III]

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

ESD201 Engineering Mechanics I [기초역학 I]

This course studies the essential and fundamental concepts of engineering mechanics, including solid mechanics, dynamics, fluid dynamics, and thermodynamics. In this course, students are expected to understand basic knowledge of system physics in order to analyze and model mechanical systems.

ESD202 Basic Circuit Theory & Lab [기초회로이론 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.

ESD204 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.

ESD206 Engineering Mechanics II [기초역학 II]

This course studies the advanced concepts of engineering mechanics, including solid mechanics, dynamics, fluid dynamics, and thermodynamics. In this course students are expected to understand advanced knowledge of system physics in order to analyze and model mechanical systems. Engineering Mechanics I is a prerequisite of this course.

ESD301 Engineering Drawing and Analysis [기계제도 및 해석]

This course not only provides the fundamental components of mechanical drawing, but also studies mechanical kinematics, system analysis and parameter optimization via simulation tools. In this course, students are expected to learn various computer simulation tools and their fundamentals for the design and development of mechanical products. Engineering Mechanics I is a prerequisite of this course.

ESD302 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.

ESD303 System Control [시스템 제어]

This course aims to introduce students to the fundamental principles of system modeling and its control. Students will study how to model the dynamics of mechanicals, electrical and hybrid systems. The topics include control system modeling, time response and frequency response analysis, classic control theory, and state space representation. Projects with MATLAB and LabView will be conducted during the course. Engineering Mechanics I and Basic Circuit Theory & Lab are recommended prerequisites for this course.

ESD401 Engineering Design Methods [공학디자인기법]

This course examines the essential engineering design methods for each step of the design process. Quality Function Deployment (QFD), functional flow analysis and morphological analysis will be studied for the product specification and the generation phases of design alternatives, whilst various optimization techniques such as interval arithmetic, constraint satisfaction & propagation algorithms and Multiple Criteria Decision Analysis (MCDA) will be discussed for the selection phase of design alternatives. Theoretical exercises with case studies will complement the course.

ESD403 Reliability Engineering [신뢰성 공학]

Reliability engineering is an engineering field that deals with the study, evaluation, and life-cycle management of reliability: the ability of a system or component to perform its required functions under stated conditions for a specified period of time. Reliability concepts and methodology for modeling, assessing and improving product reliability will be studied in this course. The topics include common models for component and system reliability, analysis of field and warranty data, component reliability inference, repairable systems, accelerated stress testing for reliability assessment, and reliability improvement through experimental design.

ESD410,420,430 Special Topics in ESD I, II, III [공학 및 시스템디자인특론 I, II, III]

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

IID303 3D CAD & Prototyping [3D CAD와 프로토타이핑]

This course deals with the Virtual Product Design Process using 3D Computer Aided Design methods. Students learn various virtual methods related to product design from transforming sketches on paper into 3D solid data, elaborated modeling, design engineering and visualization to workable prototyping methods using NC or RP technologies and conduct a small project using a virtual product design process.

IID304 Interactive technology [인터랙티브 기술]

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.

DHE312 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.

DHE313 Color Science & Design [색채과학과 디자인]

In this course students will learn color as a science and also as an art. Human visual system, color measurement systems, color order systems and psychophysical experimental methods will be taught to understand color as a science while various color combinations will be studied and applied to design works to understand color as an art. Students will conduct their projects focusing on their own interests, science or art.

MEN350 Manufacturing Processes and Lab [기계공작법 및 실습]

This 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.

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) Nano Materials Engineering (NME)

Students in Nano Materials Engineering (NME) track will learn the basic knowledges of nano materials science and engineering. NME track is directed towards understanding of various nano materials, nano structures and its applications mostly in the nano regime. Nano materials design and synthesis, nano processing and nano devices fabrications are in the scope of this specialized track. We envision that the students will pioneer realization of nano materials in modern nano science and technologies based on the knowledge of nano materials.

□ Credit Requirement

Track	Required/Elective	Credit(minimum)		
		Interdisciplinary Major		
		1st Track	2nd Track	
Advanced Materials Science	Required	21	9	
	Elective	27	9	
Nano Materials Engineering	Required	21	9	
	Elective	27	9	

□ Fundamental Course for Each track

▶ Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Materials Science and Engineering	Advanced Materials Science	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Nano Materials Engineering	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	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

Course Title	School of Materials Science and Engineering	
	AMS	MNE
Calculus I	A	A
Calculus II	O	O
Applied Linear Algebra	A	A
Differential Equations	R	R
Statistics	-	-
General Physics I	A	A
General Physics II	R	R
General Chemistry I	R	R
General Chemistry II	R	R
General Physics Lab I	R	R
General Physics Lab II	R	R
General Chemistry Lab I	R	R
General Chemistry Lab II	R	R

R : Required A : Accepted O : Optional

▶ Identical Courses (동일유사과목 지정)

AMS202 = NME202 (Introduction to Materials Science and Engineering, 재료공학개론)
AMS203 = NME203 (Thermodynamics of Materials, 재료열역학)

3. Curriculum

☐ Advanced Materials Science (AMS)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	AMS202	Introduction to Materials Science and Engineering	재료공학개론	3-3-0	
	AMS203	Thermodynamics of Materials	재료열역학	3-3-0	
	AMS230	Introduction to Crystallography	결정학개론	3-3-0	AME202 or NME202
	AMS314	Defects in Crystals	결정결함론	3-3-0	
	AMS390	Introduction to Computational Materials Science	전산재료과학개론	3-3-0	
1TR:R 2TR:E	AMS300	Materials Lab	재료실험	3-1-4	
	AMS312	Phase Transformations in Materials	재료상변태	3-3-0	
	NME313	Mechanical Behavior of Materials	재료의기계적거동	3-3-0	AME202 or NME202
	AMS350	Solid State Physics of Materials I	재료고체물리 I	3-3-0	
	AMS311	Introduction to Metallic Materials	금속재료개론	3-3-0	
	AMS351	Thin Film Technology	박막공학	3-3-0	
	AMS352	Solid State Physics of Materials II	재료고체물리 II	3-3-0	
	AMS353	Surface Science of Materials	재료표면과학	3-3-0	AMS202 or NME202
	AMS401	Transmission Electron Microscopy	전자현미경학	3-3-0	
	AMS431	Magnetic Properties of Materials	재료의 자기적 성질	3-3-0	
	AMS410	Principles of Corrosion Engineering and Prevention	재료 부식과 방식	3-3-0	
	AMS411	Extreme Environment Materials	극한환경소재	3-3-0	
	AMS460	Bio-inspired Materials Science	바이오소재과학	3-3-0	
	AMS497	Special Topics in Advanced Materials Science I	신소재과학특론 I	3-3-0	
	AMS498	Special Topics in Advanced Materials Science II	신소재과학특론 II	3-3-0	
	NME250	Modern Physics of Materials	재료현대물리	3-3-0	
	NME251	Introduction to Nanomaterials	나노재료개론	3-3-0	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	NME252	Physical Chemistry of Materials : Reaction Engineering	재료물리화학 : 반응공학	3-3-0	
	NME301	Nano Materials Lab	나노재료실험	3-1-4	
	NME315	Physical Metallurgy	물리금속학	3-3-0	NME313
	NME354	Introduction to Semiconductor	반도체개론	3-3-0	
	NME355	Introduction to nano-energy Materials	나노에너지재료	3-3-0	
	NME370	Introduction to Polymer Materials	고분자재료개론	3-3-0	
	NME371	Introduction to Flexible Electronics	유연전자소자 개론	3-3-0	
	NME430	Nano-Electroceramics	나노전자세라믹스	3-3-0	
	NME452	Nano Semiconducting Materials	나노반도체소자	3-3-0	
	NME454	Nano-Materials Reliability	나노소재신뢰성	3-3-0	
	NME455	Display Engineering	디스플레이공학	3-3-0	
	NME456	Intoduction to Nanophotonics	나노포토닉스 개론	3-3-0	
	NME470	Polymer Physics	고분자물리	3-3-0	
	MEN230	Solid Mechanics I	고체역학 I	3-3-0	
	MEN301	Numerical Analysis	수치해석	3-3-0	
	MEN431	Introduction to Plastic Deformation	소성학개론	3-3-0	
	EE221	Electromagnetics I	전자기학 I	3-3-0	
	PHY301	Quantum Mechanics I	양자물리학 I	3-3-0	PHY101, PHY102
	ENE312	Electrochemistry	전기화학	3-3-0	
	CHM211	Organic Chemistry I	유기화학 I	3-3-0	
	CHM391	Instrumental Analysis	기기분석	3-3-0	
	CHM371	Introduction to Nanochemistry	나노화학개론	3-3-0	
	CHM351	Inorganic Chemistry I	무기화학 I	3-3-0	

▶ Recommended Course Tracks (AMS)

* : Required Course, ** : Required only for 1st track, & : Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH103 *AMS202	&MTH201 *AMS203 *AMS230	NME250 NME251 NME252
3	**AMS300 **AMS312 **NME313 **AMS350 *AMS390	AMS311 *AMS314 AMS351 AMS352 AMS353	NME301 NME315 NME354 NME355 NME370 NME371
4	AMS401 AMS410 AMS460 AMS497	AMS411 AMS431 AMS498	NME430 NME452 NME454 NME455 NME456 NME470

☐ Nano Materials Engineering (NME)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	NME203	Thermodynamics of Materials	재료열역학	3-3-0	
	NME251	Introduction to Nanomaterials	나노재료개론	3-3-0	
	NME313	Mechanical Behavior of Materials	재료의기계적거동	3-3-0	AMS202 or NME202
	NME370	Introduction to Polymer Materials	고분자재료개론	3-3-0	
	NME430	Nano-Electroceramics	나노전자세라믹스	3-3-0	
1TR:R 2TR:E	NME202	Introduction to Materials Science and Engineering	재료공학개론	3-3-0	AMS202 is identical course
	NME250	Modern Physics of Materials	재료현대물리	3-3-0	
	AMS300	Materials Lab	재료실험	3-1-4	
	AMS312	Phase Transformations in Materials	재료상변태	3-3-0	
	NME252	Physical Chemistry of Materials : Reaction Engineering	재료물리화학 : 반응공학	3-3-0	
	NME301	Nano Materials Lab	나노재료실험	3-1-4	
	NME315	Physical Metallurgy	물리금속학	3-3-0	NME313
	NME354	Introduction to Semiconductor	반도체개론	3-3-0	
	NME355	Introduction to nano-energy Materials	나노에너지재료	3-3-0	
	NME371	Introduction to Flexible Electronics	유연전자소자 개론	3-3-0	
	NME452	Nano-Semiconducting Devices	나노반도체소자	3-3-0	
	NME454	Nano-Materials Reliability	나노소재신뢰성	3-3-0	
	NME455	Display Engineering	디스플레이공학	3-3-0	
	NME456	Introduction to Nanophotonics	나노포토닉스 개론	3-3-0	
	NME470	Polymer Physics	고분자물리	3-3-0	
	NME497	Special Topics in Nano Materials Engineering Ⅰ	나노재료공학특론 Ⅰ	3-3-0	
	NME498	Special Topics in Nano Materials Engineering Ⅱ	나노재료공학특론 Ⅱ	3-3-0	
	AMS230	Introduction to Crystallography	결정학개론	3-3-0	AMS202 or NME202
	AMS311	Introduction to Metallic Materials	금속재료개론	3-3-0	
	AMS314	Defects in Crystals	결정결함론	3-3-0	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	AMS350	Solid State Physics of Materials I	재료고체물리 I	3-3-0	
	AMS351	Thin Film Technology	박막공학	3-3-0	
	AMS352	Solid State Physics of Materials II	재료고체물리 II	3-3-0	
	AMS353	Surface Science of Materials	재료표면과학	3-3-0	AMS202 or NME202
	AMS390	Introduction to Computational Materials Science	전산재료과학개론	3-3-0	
	AMS401	Transmission Electron Microscopy	전자현미경학	3-3-0	
	AMS431	Magnetic Properties of Materials	재료의 자기적 성질	3-3-0	
	AMS410	Principles of Corrosion Engineering and Prevention	재료 부식과 방식	3-3-0	
	AMS411	Extreme Environment Materials	극한환경소재	3-3-0	
	AMS460	Bio-inspired Materials Science	바이오소재과학	3-3-0	
	MEN230	Solid Mechanics I	고체역학 I	3-3-0	
	MEN431	Introduction to Plastic Deformation	소성학개론	3-3-0	
	MEN301	Numerical Analysis	수치해석	3-3-0	
	EE221	Electromagnetics I	전자기학 I	3-3-0	
	PHY301	Quantum Mechanics I	양자물리학 I	3-3-0	PHY101, PHY102
	ENE312	Electrochemistry	전기화학	3-3-0	
	CHM211	Organic Chemistry I	유기화학 I	3-3-0	
	CHM391	Instrumental Analysis	기기분석	3-3-0	
	CHM371	Introduction to Nanochemistry	나노화학개론	3-3-0	
	CHM351	Inorganic Chemistry I	무기화학 I	3-3-0	

▶ Recommended Course Tracks (NME)

* : Required Course, ** : Required only for 1st track, & : Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH103 **NME202 *NMS203	&MTH201 **NME202 **NME250 *NME251 NME252	AMS230
3	*NME313 *NME370 **AMS300 **AMS312 AMS390	NME301 NME315 NME354 NME355 NME371	AMS311 AMS314 AMS350 AMS351 AMS352 AMS353
4	*NME430 NME452 NME455 NME497	NME454 NME456 NME470 NME498	AMS401 AMS410 AMS411 AMS431 AMS460

4. 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 Thermodynamics of Materials [재료열역학]

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.

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.

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.

AMS314 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.

AMS350 Solid State Physics of Materials I [재료고체물리 I]

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.

AMS351 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.

ASM352 Solid State Physics of Materials II [재료고체물리 II]

This course covers beyond the solid state physics I with a focus on the cooperative phenomena of electrons. Topics include plasmon/polariton/polaron, optical processes in solids, dielectrics and ferroelectrics, magnetism and magnetic order, superconductivity, and physics in low dimensional system.

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.

AMS390 Introduction to Computational Materials Science [전산재료과학개론]

This course will focus on introducing computational methods, numerical techniques, theories and algorithms in describing the equilibrium, kinetics, diffusion and evolution of materials. During the course, students will be exposed to first-hands-on experience in various numerical treatments and computational methods for various topics such as linear algebra, fast fourier transformation, differential equation, Monte Carlo Potts model, phase field model, finite difference/elements, and etc. The main objective of this course is let students understand the advantages, disadvantages and pitfalls of various methods, and therefore grab the idea that the computational materials science can play a fundamental role in designing structures of materials, processes and devices for better performance.

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.

AMS410 Principles of Corrosion Engineering and Prevention [재료 부식과 방식]

The focus of this course is on the fundamentals of corrosion engineering and corrosion prevention of metallic and alloy structures as well as on non-metallic composites and hybrid materials. Recent challenges in corrosion of advanced materials used in the automotive, aerospace, and marine industries as well as for underground structures for oil, gas, geothermal and tidal wave technologies will included. This course also covers most traditional and non-traditional tests for corrosion studies, including characterization techniques and analysis of corrosion phenomenon and corrosion monitoring principles.

AMS411 Extreme Environment Materials [극한환경소재]

This course covers the design, synthesis and applications of materials that can reliably withstand the extreme thermal, pressure and highly corrosive environments for long periods of time without failure. Understanding how these extreme environments affect the physical and chemical processes that occur in the bulk material and at its surface would open the door to employing these conditions to make entirely new classes of materials with greatly enhanced performance for future technologies.

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 addtion, magnetic phenomena and magnetic materials in technological applications will be introduced.

AMS460 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.

AMS497~8 Special Topics in Advanced Materials Science I ~ II [신소재과학 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.

▶ Nano Materials Engineering (NME)

NME202 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.

NME203 Thermodynamics of Materials [재료열역학]

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.

NME250 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.

NME251 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.

NME252 Physical Chemsistry of Materials : Reaction Engineering [재료물리화학 : 반응공학]

This course is designed to extend the concepts and knowledge learned from subject NME203 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.

NME301 Nanomaterials Lab [나노재료실험]

This course is a selective senior subject in the Department of Materials Science and Engineering for Organic, Semiconducting and Metalic Materials. The laboratory subject combines experiments illustrating electrical/optical/magnetic properties of materials and structure-property relationships through practical materials.

NME313 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.

NME315 Physical Metallurgy [물리금속학]

The objective of this course is to reinforce fundamental concepts and introduce advanced topics in physical metallurgy with emphasis on microstructural evolution and structure-properties relations. Topics will include equilibrium phase diagrams, thermodynamics, diffusional and martensitic transformation kinetics, recrystallization, and grain growth etc.

NME354 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.

NME355 Introduction to Nano-Energy Materials [나노에너지재료]

This course deals with basic nano-energy materials such as metal-oxide, polymer and carbon based materials (graphene, graphene oxide, carbon nanotube, and etc) to realize electrochemical, piezoeletric, and thermoelectric devices. In addition, students will learn fundamental principles of the devices and the characterization of the materials and the devices.

MSE370 Introduction to Polymer Materials [고분자재료개론]

This course is designed to provide an introduction to the basic concept of polymer and various kinds of polymer materials. Students will learn basic chemical synthesis and polymer properties such as thermal, chemical, physical, mechanical, and electro-optic characteristics.

NME371 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.

NME430 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.

NME452 Nano-Semiconducting Devices [나노반도체소자]

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.

NME454 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.

NME455 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.

NME456 Introduction to Nanophotonics [나노포토닉스개론]

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.

MSE470 Polymer Physics [고분자물리]

This course introduces natural and synthetic polymers and their physical properties. Students will learn structure and property of polymers starting from the single chain conformation. The emphasis is on the universial static and dynamic behavior of polymers in solvents and melts. In addition this course covers basic chemical synthesis and chemical property of polymers.

NME497~8 Special Topics in Nano Materials Engineering I~II [나노재료공학 특론 I~II]

This course covers cutting-edge technologies with applications in nano materials engineering, especially on nanostructured materials, multi-functional composites, hybrid polymer materials, spintronics materials, organic/inorganic optical materials, electronic materials, low-dimensional materials, optoelectronic materials, and nano-devices. This content is changeable 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)		
		Interdisciplinary Major		
		1st Track	2nd Track	
Energy Engineering	Required	28	12	
	Elective	20	6	
Chemical Engineering	Required	21	15	
	Elective	27	3	

□ Fundamental Course for each track

▶ Required Mathematics Course of Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Energy and Chemical Engineering	Energy Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
	Chemical Engineering	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	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.

▶ Required IT Courses

School	Programming	Practical IT	Designated course by the school		
			Track	Course No.	Title
School of Energy and Chemical Engineering	Engineering Programming I	Engineering Programming II	Energy Engineering	ENE480	Scientific Expression with IT
			Chemical Engineering	ACE301	Computational Methods for Chemical Engineering

※ Complete based on 1TR
※ Students whose 1st track is Chemical Engineering and who entered after 2010 should take 'Computational Methods for Biological and Chemical Engineering'.
※ Students whose 1st track is Energy Engineering and who completed dynamics of IT or designated IT course by 2013 1st term are not required to complete.

▶ Required Experimental Courses

School	Track	Required Courses	Remarks
Energy and Chemical Engineering	Energy Engineering	ENE223 Lab for Energy Materials ENE314 Energy conversion and storage lab ENE323 Solar cells lab	Choose two
	Chemical Engineering	ACE242 Engineering Biology Laboratory ACE361 Organic /Physical Chemistry Laboratory ACE302 Advanced Chemical Engineering Laboratory CHM201 Organic Chemistry Laboratory I	Choose one

※ Complete based on 1TR
※ Students whose 1st track is Energy Engineering and who were admitted in 2009 are not required to complete.

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

Course Title	School of Energy Engineering	
	ENE	ACE
Calculus I	R	A
Calculus II	R	O
Applied Linear Algebra	A	A
Differential Equations	A	R
Statistics	–	–
General Physics I	R	A
General Physics II	R	R
General Chemistry I	R	R
General Chemistry II	R	R
General Physics Lab I	O	O
General Physics Lab II	O	O
General Chemistry Lab I	O	R
General Chemistry Lab II	O	R

R : Required A : Accepted O : Optional

▶ Identical Courses with other tracks

Course
ACE201 Organic Chemistry I= CHM211 Organic Chemistry I=ENE211 Organic Chemistry I
ACE202 Organic Chemistry II= CHM212 Organic Chemistry II=ENE221 Organic Chemistry II
CHM231 Physical Chemistry I= ENE212 Physical Chemistry I
CHM351 Inorganic Chemistry I= ENE311 Inorganic Chemistry I
CHM352 Inorganic Chemistry II= ENE311 Inorganic Chemistry II
ACE321 Solid State Chemistry I = CHM454 Solid State Chemistry = ENE313 Solid State Chemistry I
ACE352 Polymer Materials = ENE321 Polymer Material Science
CHM291 Analytical Chemistry I = ENE213 Analytical Chemistry
CHM391 Instrumental Analysis= ENE322 Instrumental Analysis = ACE391 Instrumental Analysis
ACE351 Introduction to Polymer Science and Engineering = ENE226 Polymer Concepts

3. Curriculum

□ Energy engineering (ENE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Remarks
Required Group	ENE211	Organic Chemistry I	유기화학 I	3-3-0	
	ENE212	Physical Chemistry I	물리화학 I	3-3-0	
	ENE213	Analytical Chemistry	분석화학	3-3-0	
	ENE221	Organic Chemistry II	유기화학 II	3-3-0	
	ENE222	Physical Chemistry II : Kinetics	물리화학 II : 동역학	3-3-0	
	ENE223	Lab for Energy Materials	에너지 재료 실험	2-0-4	
	ENE311	Inorganic Chemistry I	무기화학 I	3-3-0	
	ENE312	Electrochemistry	전기화학	3-3-0	
	ENE313	Solid State Chemistry I	고체화학 I	3-3-0	
	ENE314	Energy Conversion and Storage Lab	에너지변환 및 저장실험	2-0-4	
	ENE321	Polymer Material Science	고분자재료과학	3-3-0	
	ENE322	Instrumental Analysis	기기분석	3-3-0	
	ENE323	Solar Cells Lab	태양전지실험	2-0-4	
Elective	ENE216	Fundamentals of Materials Science	재료과학개론	3-3-0	
	ENE226	Polymer Concepts	고분자과학개론	3-3-0	
	ENE316	Electronic Devices	전자소자	3-3-0	
	ENE317	Fundamentals of Energy Materials	에너지재료개론	3-3-0	
	ENE318	Introduction to Solar Cells	태양전지공학입문	2-0-4	
	ENE319	Physical Chemistry III : Quantum Mechanics	물리화학 III : 양자역학	3-3-0	
	ENE326	Inorganic Chemistry II	무기화학 II	3-3-0	
	ENE327	Solid State Chemistry II	고체화학 II	3-3-0	
	ENE328	Fundamentals of Energy Conversion Systems	에너지 변환 시스템 개론	3-3-0	
	ENE400	Special Topics in ECS I	에너지공학특론 I	3-3-0	
	ENE401	Special Topics in ECS II	에너지공학특론 II	3-3-0	
	ENE402	Special Topics in ECS III	에너지공학특론 III	3-3-0	
	ENE403	Special Topics in ECS IV	에너지공학특론 IV	3-3-0	
	ENE404	Special Topics in ECS V	에너지공학특론 V	3-3-0	
	ENE416	Introduction to Nanoscience and Nanotechnology	나노과학 및 기술	3-3-0	
	ENE480	Scientific Expression with IT	공학IT개론	3-2-2	

▶ Recommended Course Tracks (ENE)

* : Required Course, ** : Fundamental Course

Year/Sem.	I (Spring)	II (Fall)	Remark
2	**MTH201(Differential Equations) *ENE211(Organic Chemistry I) *ENE212(Physical Chemistry I) *ENE213(Analytical Chemistry) ENE216(Fundamentals of Materials Science)	**MTH103(Applied Linear Algebra) *ENE223(Lab for Energy Materials) *ENE222(Physical Chemistry II : Kinetics) *ENE221(Organic Chemistry II) ENE226(Polymer Concepts)	

3	*ENE311(Inorganic Chemistry I)
	*ENE312(Electrochemistry)
	*ENE313(Solid State Chemistry I)
	*ENE314(Energy Conversion and Storage Lab)
	ENE316(Electronic Devices)
	ENE317(Fundamentals of Energy Materials)
	ENE318(Introduction to Solar Cells)
	ENE319(Physical Chemistry III : Quantum Mechanics)
		*ENE314(Energy Conversion and Storage Lab)
		*ENE321(Polymer Material Science)
		*ENE322(Instrumental Analysis)
		*ENE323(Solar Cells Lab)
		#ENE480(Scientific Expression with IT)
		ENE326(Inorganic Chemistry II)
		ENE327(Solid State Chemistry II)
		ENE328(Fundamentals of Energy Conversion Systems)	

4	ENE416(Introduction to Nanoscience and Nanotechnology)		

□ Chemical engineering (ACE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	ACE201	Organic Chemistry I	유기화학 I	3-3-0	
	ENE212	Physical Chemistry I	물리화학 I	3-3-0	
	ACE311	Chemical Reaction Engineering	반응공학	3-3-0	
	ACE331	Transport Phenomena I	전달현상 I	3-3-0	MTH201, ENE212 or CHM231
	ACE351	Introduction to Polymer Science and Engineering	고분자과학개론	3-3-0	
1tr(R), 2tr(E)	ACE212	Introduction to Chemical Process	화학공정개론	3-3-0	
	ACE231	Chemical Engineering Thermodynamics	화공열역학	3-3-0	
Elective	ACE202	Organic Chemistry II	유기화학 II	3-3-0	
	ACE241	Fundamentals in Engineering Biology	화학생명공학	3-3-0	
	ACE242	Engineering Biology Laboratory	화학생명공학실험	3-3-0	
	ACE301	Computational Methods for Chemical Engineering	화학공학전산	3-3-0	
	ACE302	Advanced Chemical Engineering Laboratory	첨단화학공학실험	2-0-4	
	ACE321	Solid State Chemistry I	고체화학 I	3-3-0	
	ACE332	Transport Phenomena II	전달현상 II	3-3-0	
	ACE341	Introduction to Molecular Biotechnology	분자생명공학개론	3-3-0	
	ACE352	Polymer Materials	고분자재료	3-3-0	
	ACE361	Organic/Physical Chemistry Laboratory	유기물리화학실험	2-0-4	
	ACE391	Instrumental Analysis	기기분석	3-3-0	
	ACE431	Introduction to Catalysis	촉매개론	3-3-0	
	ACE401	Special Topics in Chemical Engineering I	화학공학특론 I	3-3-0	
	ACE402	Special Topics in Chemical Engineering II	화학공학특론 II	3-3-0	
	ACE403	Special Topics in Chemical Engineering III	화학공학특론 III	3-3-0	
	AMS202	Introduction to Materials Science and Engineering	재료공학개론	3-3-0	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
	AMS351	Thin Film Technology	박막공학	3-3-0	
	BIO211	Biochemistry I	생화학 I	3-3-0	
	BME323	Biochemical Engineering	생물화학공학	3-3-0	
	CHM201	Organic Chemistry Laboratory I	유기화학실험 I	2-0-4	
	CHM232	Physical Chemistry II	물리화학 II	3-3-0	
	CHM291	Analytical Chemistry	분석화학	3-3-0	
	CHM333	Physical Chemistry III	물리화학 III	3-3-0	
	CHM351	Inorganic Chemistry I	무기화학 I	3-3-0	
	CHM371	Introduction to Nanochemistry	나노화학개론	3-3-0	
	EE201	Basic Circuit Theory	회로이론	3-3-0	
	ENE312	Electrochemistry	전기화학	3-3-0	
	ENE318	Introduction to Solar Cells	태양전지공학입문	3-3-0	
	ENE326	Inorganic Chemistry II	무기화학 II	3-3-0	
	MEN211	Applied Thermodynamics	응용열역학	3-3-0	
	NME454	Nano-Materials Reliability	나노소재신뢰성	3-3-0	
	NME452	Nano Semiconducting Materials	나노반도체소자	3-3-0	

▶ Recommended Course Tracks (ACE)

* : Required Course, ** : Required only for 1 track, & : Required Math

Year/ Sem.	I (Spring)	II (Fall)	Remark
2	&MTH103(Applied Linear Algebra) *ACE201(Organic Chemistry I) *ENE212(Physical Chemistry I) **ACE212(Introduction to Chemical Process) ACE241(Fundamentals in Engineering Biology) BIO211(Biochemistry I) CHM291(Analytical Chemistry I)	&MTH201(Differential Equations) **ACE231(Chemical Engineering Thermodynamics) ACE202(Organic Chemistry II) ACE242(Engineering Biology Laboratory) CHM201(Organic Chemistry Laboratory I) CHM232(Physical Chemistry II) MEN211(Applied Thermodynamics)	
3	*ACE311(Chemical Reaction Engineering) *ACE331(Transport Phenomena I) **ACE351(Introduction to Polymer Science and Engineering) ACE302(Advanced Chemical Engineering Laboratory) ACE361(Organic/Physical Chemistry Laboratory) ACE341(Introduction to Molecular Biotechnology) CHM333(Physical Chemistry III) ENE312(Electrochemistry) ENE318(Introduction to Sola Cells)	*ACE311(Chemical Reaction Engineering) ACE301(Computational Methods for Chemical Engineering) ACE321(Solid State Chemistry I) ACE332(Transport Phenomena II) ACE352(Polymer Materials) ACE391(Instrumental Analysis) BME323(Biochemical Engineering) AMS351(Thin film Mechanics) ENE326(Inorganic Chemistry II) CHM371(Introduction to Nanochemistry)	
4	NME452(Nano Semiconducting Materials)	ACE431(Introduction to Catalysis) NME454(Nano-Materials Reliability)	

* It is mandatory that students whose 2nd track is Chemical Engineeirng take all major courses chosen only from ACE code courses.
* NBC students must check for viable replacement courses according to the course replacement list before registration.

4. 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.

ENE212NPhysical 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.

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 [에너지재료실험]

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.

ENE318 Introduction to Solar Cells [태양전지공학입문]

Human need energy for a living. Although we obtain energy from food to sustain our body, we need more and more energy to keep our life comfortable. The first thing we can keep in mind for this might be electricity. Since the electrical energy can be converted almost every other energy form (heat, light etc.), direct conversion from sun light to electricity is very important. Based on the same reason, producing electrical energy through photovoltaic energy conversion by solar cells is the human counterpart. This course provides a fundamental understanding of the functioning of solar cells. The discussion includes the solar cell structures, various kinds of them, their theoretic parts, and analysis tools.

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.
torage performance tests.

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.

ENE328 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.

ENE400~4 Special Topics in ECS I ~ V [에너지공학 특론 I ~ V]

This course introduces new research topics in energy conversions and storage.

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

ENE480 Scientific Expression with IT [공학IT개론]

The scientific research often requires IT technologies to obtain effective data, understand the meaning of numbers, or explain what they actually show. There are many programming tools to express scientific data. For instances, software "Origin" enables us to manipulate various graphs to obtain specific meaning, and software "Chemdraw" give us effective molecular geometry. In addition, "Endnote" makes it facile to handle the references. This course will give you chances to approach more IT-adopted scientific expression through various programs, which will include Origin, Chemdraw, Endnote, and 3DMAX, etc.

▶ 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.

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.

ACE241 Fundamentals in Engineering Biology [화학생명공학]

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 Engineering Biology Laboratory [화학생명공학실험]

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.

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.

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.

ACE321 Solid State Chemisty 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.

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.

ACE341 Introduction to Molecular Biotechnology [분자생명공학개론]

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.

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.

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.

ACE401~3 Special Topics in Chemical Engineering I~III [화학공학특론 I~III]

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.

School of Electrical and Computer Engineering

1. School Introduction

The school of electrical and computer engineering at UNIST is dedicated to educating students in interdisciplinary scholarship that will serve for our future society. Our teaching and research take places in interdisciplinary programs and institutes where traditional departmental boundaries are things of the past. Our mission is to provide enabling technologies for the future way of life through the convergence of electrical and computer engineering with new nano, bio, and environmental technologies. Our efforts will bring out exciting new technologies that will contribute not only to Ulsan's world-leading automotive, shipbuilding, and petroleum industries but also to industries and societies world-wide. The school of ECE is establishing collaborations with universities and companies on the other parts of the globe to provide global environment for education and researches. Come join our efforts to become a world leading institute in science and technology.

2. Undergraduate Programs

□ Track Introduction

1) Electrical Engineering (EE)

EE is a field of engineering that deals with everything from solid-state devices and designing integrated circuits to developing information and control systems. It focuses on research and development of IT convergence systems which are capable of enriching the future life of human being to be pleasant, secured, convenient and socially connected. A broad range of IT technologies in the EE areas are to be proactively merged together to create new benefits with the advent of ubiquitous information society driven by digital convergence. EE track encourages students and researchers alike to initiate a wide range of interactions among different areas in wireless communications and networking, intelligent control and assistive robotics, multimedia signal processing, digital/analog circuits design, VLSI design, high speed mixed-signal IC, RF and wireless IC design, power electronics and power interface circuit design, semiconductor devices, plasma and microwave engineering, optoelectronic devices. EE track encompasses the experimentation, design, modeling, simulation and analysis of devices, circuits as well as complete systems. The combination of the educational program and the leading edge testing facilities provides a full cycle exposure from concept to product realization, necessary for a top-notch quality engineer that can bring immediate contributions in both academia and industries.

2) Computer Science and Engineering (CSE)

While most of people are familiar with computers, not many people have a good understanding of what computer science and engineering (CSE) is really about. Implementation of computer programs that improve the quality of human life is an important aspect of computer science and engineering, however learning how to write computer programs is not the core discipline of computer science but just a necessary skill to implement and prove creative and innovative computational logics and ideas in many broad sub-areas of computer science such as algorithms, theoretical computer science, programming languages, operating systems, databases, networks, computer security, computer graphics, artificial intelligence, and many more. In CSE track, students learn foundational principles of the core sub-areas of computer science. Having this curriculum, we cultivate the finest computer scientists and engineers that have the ability of conducting highly creative and innovative research and creating high-quality computing solutions.

□ Credit Requirement

Track	Required/Elective	Credit(minimum)		Remark
		Interdisciplinary Major		
		1st Track	2nd Track	
Electrical Engineering	Required	36	18	
	Elective	12	0	
Computer Science & Engineering	Required	36	9	
	Elective	12	9	

Fundamental Course for each track

Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Electrical and Computer Engineering	Electrical Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1
	Computer Science & Engineering	MTH103	Applied Linear Algebra	2-2
		MTH201	Differential Equations	2-1

※ 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

Course Title	School of Electrical and Computer Engineering	
	EE	CSE
Calculus I	A	A
Calculus II	O	O
Applied Linear Algebra	A	A
Differential Equations	R	R
Statistics	-	-
General Physics I	A	A
General Physics II	R	R
General Chemistry I	O	O
General Chemistry II	O	O
General Physics Lab I	R	R
General Physics Lab II	R	R
General Chemistry Lab I	O	O
General Chemistry Lab II	O	O

R : Required A : Accepted O : Optional

3. Curriculum

☐ Electrical Engineering (EE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	CSE201	Digital System Lab	디지털시스템실험	3-2-2	
	EE201	Basic Circuit Theory	회로이론	3-3-0	
	EE231	Electromagnetics I	전자기학 I	3-3-0	
	EE301	Microelectronics Ⅰ	전자회로 Ⅰ	3-3-0	EE201
	EE311	Signals and Systems	신호및시스템	3-3-0	
	EE321	Electronics Experiment Laboratory	전자회로실험	3-1-4	CSE201, EE201, EE301
1TR:R 2TR:E	EE211	Probability and Introduction to Random Processes	확률과 랜덤프로세스개론	3-3-0	
	EE302	MicroelectronicsⅡ	전자회로Ⅱ	3-3-0	EE301
	EE312	Introduction to Communications	통신개론	3-3-0	EE311, EE211
	EE313	Introduction to Control	자동제어공학개론	3-3-0	EE311
	EE331	Introduction to electronic devices	전자소자개론	3-3-0	
	EE411	Digital Signal Processing	디지털신호처리	3-3-0	EE311
Elective	EE401	Analog Integrated Circuits	아날로그집적회로설계	3-3-0	EE301, EE302
	EE402	Introduction to VLSI Design	초고밀도 집적회로 설계	3-3-0	EE301
	EE403	Introduction to RF Engineering	RF 공학 개론	3-3-0	EE201, EE301
	EE404	Fundamentals of Power Electronics	전력전자공학개론	3-3-0	EE301, EE313
	EE412	Communication Systems	통신시스템	3-3-0	EE312
	EE413	Introduction to Data Networks	데이터 네트워크 개론	3-3-0	EE211
	EE431	Semiconductor VLSI Devices Engineering	반도체집적소자공학	3-3-0	
	EE432	Optoelectronics	광전자공학	3-3-0	
	CSE221	Data Structures	데이터구조	3-3-0	
	CSE241	Object Oriented Programming	객체 지향 프로그래밍	3-3-0	
	CSE463	Machine Learning	기계 학습	3-3-0	
	PHY204	Electromagnetism II	전자기학 II	3-3-0	
	PHY416	Semiconductor Physics	반도체물리학	3-3-0	
	PHY427	Introduction to Plasma Physics	플라즈마 물리학 입문	3-3-0	
	EE480	Special Topics in EE Ⅰ	전자및전기공학특론 Ⅰ	3-3-0	
	EE481	Special Topics in EE Ⅱ	전자및전기공학특론 Ⅱ	3-3-0	
	EE482	Special Topics in EE Ⅲ	전자및전기공학특론 Ⅲ	3-3-0	
	EE483	Special Topics in EE Ⅳ	전자및전기공학특론 Ⅳ	3-3-0	
	EE484	Special Topics in EEⅤ	전자및전기공학특론 Ⅴ	3-3-0	

▶ Recommended Course Schedule for EE Track.

* : Required Course, ** : Required only for 1st track, &: Required Math

Year/Sem.	I (Spring)	II (Fall)
2	&MTH201(Differential Equations,미분방정식) *EE231(Electromagnetics I, 전자기학 I) *CSE201(Digital System Lab,디지털시스템실험) CSE241(Object Oriented Programming, 객체 지향 프로그래밍)	&MTH103(Applied Linear Algebra,응용선형대수) *EE201(Basic Circuit Theory, 회로이론) **EE211(Probability and Introduction to Random Processes, 확률과 랜덤프로세스개론) CSE221(Data Structures,데이터구조) PHY204(Electromagnetism II,전자기학 II)
3	*EE301(Microelectronics I ,전자회로 I) *EE311(Signals and Systems,신호및시스템) **EE331(Introduction to electronic devices, 전자소자개론)	**EE302(MicroelectronicsII, 전자회로II) **EE312(Introduction to Communications, 통신개론) **EE313(Introduction to Control,자동제어공학개론) *EE321(Electronics Experiment Laboratory, 전자회로실험)
4	EE401(Analog Integrated Circuits, 아날로그집적회로설계) EE402(Introduction to VLSI Design, 초고밀도 집적회로 설계) EE404(Fundamentals of Power Electronics, 전력전자공학개론) **EE411(Digital Signal Processing, 디지털신호처리) EE412(Communication Systems,통신시스템) EE432(Optoelectronics,광전자공학) PHY416(Semiconductor Physics, 반도체물리학)	EE403(Introduction to RF Engineering,RF 공학 개론) EE413(Introduction to Data Networks, 데이터 네트워크 개론) EE431(Semiconductor VLSI Devices Engineering, 반도체집적소자공학 CSE463(Machine Learning,기계 학습) PHY427(Introduction to Plasma Physics, 플라즈마 물리학 입문)

□ Computer Science & Engineering (CSE)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	CSE221	Data Structures	데이터구조	3-3-0	CSE241
	CSE241	Object Oriented Programming	객체 지향 프로그래밍	3-3-0	
	CSE331	Introduction to Algorithms	알고리즘	3-3-0	CSE232
1TR:R 2TR:E	CSE201	Digital System Lab	디지털시스템실험	3-2-2	
	EE201	Basic Circuit Theory	회로이론	3-3-0	
	EE211	Probability and Introduction to Random Processes	확률과 랜덤프로세스개론	3-3-0	
	CSE232	Discrete Mathematics	이산수학	3-3-0	
	CSE301	Computer Organization	컴퓨터조직론	3-3-0	CSE201, CSE241
	CSE311	Operating Systems	운영체제	3-3-0	CSE241, CSE221
	CSE332	Theory of Computation	계산 이론	3-3-0	
	CSE341	Principles of Programming Languages	프로그래밍언어	3-3-0	CSE241
	CSE351	Computer Networks	컴퓨터네트워크	3-3-0	CSE241, EE211
Elective	CSE411	Introduction to Compilers	컴파일러 개론	3-3-0	
	CSE412	Parallel Computing	병렬 컴퓨팅	3-3-0	
	CSE421	Database Systems	데이터베이스 시스템	3-3-0	CSE241, CSE221
	CSE461	Software System Design	소프트웨어시스템디자인	3-3-0	
	CSE462	Artificial Intelligence	인공지능	3-3-0	CSE331
	CSE463	Machine Learning	기계 학습	3-3-0	
	CSE464	Software Engineering	소프트웨어 공학	3-3-0	
	CSE471	Computer Graphics	컴퓨터 그래픽스	3-3-0	CSE241, CSE221
	CSE480	Special Topic in CSE I	컴퓨터 공학 특론 I	3-3-0	
	CSE481	Special Topic in CSE II	컴퓨터 공학 특론 II	3-3-0	
	CSE482	Special Topic in CSE III	컴퓨터 공학 특론 III	3-3-0	
	CSE483	Special Topic in CSE Ⅳ	컴퓨터 공학 특론 Ⅳ	3-3-0	
	CSE484	Special Topic in CSE Ⅴ	컴퓨터 공학 특론 Ⅴ	3-3-0	

▶ Recommended Course Schedule for CSE Track

* : Required Course, ** : Required only for 1st track, &: Required Math

Year/Sem.	I (Spring)	II (Fall)
2	&MTH201(Differential Equations,미분방정식) **CSE201(Digital System Lab,디지털시스템실험) *CSE241(Object Oriented Programming, 객체 지향 프로그래밍) **CSE232(Discrete Math, 이산수학)	&MTH103(Applied Linear Algebra,응용선형대수) *CSE221(Data Structures,데이터구조) **EE201(Basic Circuit Theory,회로이론) **EE211(Probability and Introduction to Random Processes, 확률과 랜덤프로세스개론)
3	**CSE301(Computer Organization,컴퓨터조직론) *CSE331(Introduction to Algorithms,알고리즘) **CSE341(Principles of Programming Languages, 프로그래밍언어)	**CSE311(Operating Systems,운영체제) **CSE332(Theory of Computation,계산 이론) **CSE351(Computer Networks,컴퓨터네트워크)
4	CSE421(Database Systems,데이터베이스 시스템) CSE462(Artificial Intelligence,인공지능) CSE464(Software Engineering,소프트웨어 공학) CSE471(Computer Graphics,컴퓨터 그래픽스)	CSE411(Introduction to Compilers,컴파일러 개론) CSE412(Parallel Computing,병렬 컴퓨팅) CSE461(Software System Design,소프트웨어시스템디자인) CSE463(Machine Learning,기계 학습)

4. 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.

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 Introduction to Communications [통신개론]

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 Introduction to Control [자동제어공학개론]

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.

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 Introduction to Electronic Devices [전자소자개론]

This course first covers the 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 various electronic devices such as PN junction, bipolar transistor, Metal/Semiconductor junction, field effect transistor, microwave devices, and photonic devices.

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.

EE403 Introduction to RF Engineering [RF공학개론]

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.

EE404 Fundamentals of Power Electronics [전력전자공학개론]

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 Communication Systems [통신시스템]

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.

EE413 Introduction to Data Networks [데이터 네트워크 개론]

This course provides an introduction to data networks. The topics covered in the course include the

OSI 7-layer architecture and mathematical modeling of its underlying peer-to-peer protocols, with an emphasis on lower layers such as data link, MAC, and network layers.

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 ~ V [전자및전기공학특론 I ~ V]

This course introduces new research topics in the field of Electrical Engineering.

▶ Computer Science & Engineering (CSE)

CSE201 Digital System Lab [디지털 시스템 실험]

To understand the basic principles of digital logic circuit, this course introduces the fundamental concepts, components and operations of digital system. TTL, ECL, CMOS, binary system, Boolean algebra and logic gate, combinational logic, and sequential logic are covered.

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.

CSE301 Computer Organization [컴퓨터조직론]

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.

CSE461 Software System Design [소프트웨어 시스템 디자인]

The aim of this course is for students to obtain hands-on software development skills in large software systems by designing and implementing diverse applications.

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.

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.

CSE480~4 Special Topics in CSE Ⅰ ~ Ⅴ [컴퓨터공학특론 Ⅰ ~ Ⅴ]

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

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) 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 and biomaterials and so on.

2) 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.

☐ Credit Requirement

Track	Required/Elective	Credit(minimum)	
		Interdisciplinary Major	
		1st Track	2nd Track
Biomedical Engineering	Required	27	12
	Elective	21	6
Biological Sciences	Required	23	15
	Elective	25	3

☐ Fundamental Course for each track

▶ Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Life Sciences	Biomedical Engineering	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Biological Sciences	MTH103	Applied Linear Algebra	2-1
		MTH211	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.

▶ Required IT Courses

School	Programming	Practical IT	Designated course by the school		
			Track	Course No.	Title
School of Life Sciences	Engineering Programming I	Engineering Programming II	Biomedical Engineering	-	-
			Biological Sciences	-	-

※ Complete based on 1T
※ NBC students should take an IT replacement course instead of 'Computational Methods for Biological and Chemical Engineering' from the course replacement list.

▶ **Fundamentals required to Business field students when they choose Engineering field tracks**

Course Title	School of Life Sciences	
	BME	BIO
Calculus I	A	A
Calculus II	O	O
Applied Linear Algebra	A	A
Differential Equations	R	O
Statistics	–	A
General Physics I	A	A
General Physics II	R	O
General Chemistry I	R	R
General Chemistry II	R	R
General Physics Lab I	O	O
General Physics Lab II	O	O
General Chemistry Lab I	O	O
General Chemistry Lab II	O	O

R : Required A : Accepted O : Optional

3. Curriculum

□ Biomedical Engineering (BME)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	BME211	Introduction to Biomedical Engineering	생명공학개론	3-3-0	
	BME212	Bio-instrumental Analysis	바이오기기분석	3-3-0	
	BME301	Computational Methods for Biosciences and Bioengineering	생명과학생명공학전산	3-3-0	
	BME311	Transport Phenomena in Biological Systems	생체유체역학	3-3-0	MTH201
	BIO301	Cell Biology	세포생물학	3-3-0	
	BIO332	Anatomy and Physiology	해부및생리학	3-3-0	
	BME411	Physical Biology of the Cell	세포생물물리학	3-3-0	
	BME413	Biomedical Instrumentation Laboratory	의료기기실험	3-1-4	
	BME435	Biomaterials and Tissue Engineering	바이오재료 및 조직공학	3-3-0	
	BME319	Optics and Imaging	광학이미징	3-3-0	
	BME323	Biochemical Engineering	생물화학공학	3-3-0	
	BME431	Biomedical Imaging	의생명이미징	3-3-0	
	BME421	Nano-Bioengineering	나노바이오공학	3-3-0	
	BME401	Special Topics in Biomedical Engineering I	생명공학특론 I	3-3-0	
	BME402	Special Topics in Biomedical Engineering II	생명공학특론 II	3-3-0	
	BME403	Special Topics in Biomedical Engineering III	생명공학특론 III	3-3-0	
	BIO201	Molecular Biology	분자생물학	3-3-0	
	BIO202	Molecular Biology Laboratory	분자생물학실험	2-0-4	
	BIO211	Biochemistry I	생화학 I	3-3-0	
	ACE201 or CHM211	Organic Chemistry I	유기화학 I	3-3-0	
	ACE311	Chemical Reaction Engineering	반응공학	3-3-0	
	ACE352[a]	Polymer Materials	고분자재료	3-3-0	
	CHM372[a]	Introduction to Polymer Chemistry	고분자화학개론	3-3-0	
	NME370[a]	Introduction to Polymer Materials	고분자재료개론	3-3-0	
	ACE341	Introduction to Molecular Biotechnology	분자생명공학개론	3-3-0	

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	AMS460	Bio-spired Materials Science	바이오소재과학	3-3-0	
	CHM231	Physical Chemistry I	물리화학 I	3-3-0	
	CHM291	Analytical Chemistry I	분석화학 I	3-3-0	
	CHM371	Introduction to Nanochemistry	나노화학개론	3-3-0	
	CHM473	Nanomaterials Chemistry	나노재료화학	3-3-0	
	CSE463	Machine Learning	기계학습	3-3-0	
	EE201	Basic Circuit Theory	회로이론	3-3-0	
	EE231 or PHY203	Electromagnetics I	전자기학 I	3-3-0	
	EE211	Probability and Introduction to Random Processes	확률과 랜덤프로세스 개론	3-3-0	
	EE311	Signals and Systems	신호 및 시스템	3-3-0	
	EE301	Microelectronics I	전자회로 I	3-3-0	EE201
	EE331	Introduction to electronic devices	전자소자개론	3-3-0	
	EE411	Digital Signal Processing	디지털신호처리	3-3-0	EE311
	EE412	Communication Systems	통신시스템	3-3-0	EE312
	EE432	Optoelectronics	광전자공학	3-3-0	
	ESD202	Basic Circuit Theory & Lab	기초회로이론 및 실습	3-3-2	
	MEN451	Introduction to MEMS	MEMS개론	3-3-0	
	NME202 or AMS202	Introduction to Materials Science and Engineering	재료공학개론	3-3-0	
	MEN472	Introduction to Sensors	센서개론	3-3-0	
	PHY213	Modern Physics	현대물리학	3-3-0	
	PHY303	Thermal and Statistical Physics	열 및 통계물리학	3-3-0	PHY101, PHY102
	PHY301[b]	Quantum Physics I	양자물리 I	3-3-0	PHY101, PHY102
	CHM232[b]	Physical Chemistry II	물리화학 II	3-3-0	

* a : Select one of three courses marked with superscript "a".
* b : Select one of two courses marked with superscript "b".

▶ Recommended Course Tracks (BME)

* : Required for 1st track and 2nd track, ** : Required only for 1st track, & : Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH103(Applied Linear Algebra) *BME211(Introduction to Biomedical Engineering)	&MTH201(Differential Equations) **BME212(Bio-instrumental Analysis)	
	BIO211(Biochemistry I) CHM211(Organic Chemistry I) CHM231(Physical Chemistry I) EE231 or PHY203(Electromagnetics I) PHY213(Modern Physics)	BIO201(Molecular Biology) BIO202(Molecular Biology Lab) NME202(Introduction to Materials Science and Engineering) EE201(Basic Circuit Theory) EE211(Probability and Introduction to Random Processes)	
3	*BME311(Transport Phenomena in Biological Systems) **BIO301(Cell Biology)	*BME301(Computational Methods for Biosciences and Bioengineering) **BIO332(Anatomy and Physiology) **BME413(Biomedical Instrumentation Laboratory)	
	BME319(Optics and Imaging) ACE311(Chemical Reaction Engineering) ACE341(Introduction to Molecular Biotechnology) NME370(Introduction to Polymer Materials) EE311(Signals and Systems) EE301(Microelectronics I) EE331(Introduction to electronic devices)	BME323(Biochemical Engineering) ACE311(Chemical Reaction Engineering) ACE352(Polymer Materials) CHM371(Introduction to Nanochemistry) CHM372(Introduction to Polymer Chemistry) PHY303(Thermal and Statistical Physics)	
4	**BME411(Physical Biology of the Cell) *BME435(Biomaterials and Tissue Engineering)		
	BME421(Nano-Bioengineering) AMS460(Bio-inspired Materials Science) EE411(Digital Signal Processing) MEN451(Introduction to MEMS) EE412(Communication Systems) EE432(Optoelectronics)	BME431(Biomedical Engineering) MEN472(Introduction to Sensors) CHM473(Nanomaterials Chemistry) CSE463(Machine Learning) ESD202(Basic Circuit Theory & Lab)	

* It is mandatory that students whose 2nd track is Biomedical Engineering take all courses chosen only from BME code courses.
* NBC students must check for viable replacement courses according to the course replacement list before registration.

▶ 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, Biomedical Imaging, Biomaterials, and Physical Biology, 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/Sem.	Area of Interest (Elective Course Only)			
	Biomedical Devices	Biomedical Imaging	Biomaterials	Physical Biology
2	CHM211 CHM231 BIO201 BIO211 BIO202	EE201 EE231 or PHY203 PHY301 or CHM232 PHY213	BIO211 CHM211 CHM231 NME251 NME202 or AMS202	PHY203 PHY213 EE211 BIO202
3	BME319 BME323 CHM371 ACE311 NME202	BME319 EE311	BIO201 ACE341 CHM371 CHM372 or NME370 or ACE352	EE311 PHY303
4	BME431 BME421 CHM473 MEN451 MEN472 AMS460 ESD202 or EE201	BME431 EE411	BME421 BME431 CHM473 MEN451 AMS460	CSE463

☐ Biological Sciences (BIO)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	BIO211	Biochemistry I	생화학 I	3-3-0	
	BIO201	Molecular Biology	분자생물학	3-3-0	
	BIO301	Cell Biology	세포생물학	3-3-0	1st track only, BIO211, BIO201
	BIO302	Developmental Biology	발생학	3-3-0	1st track only, BIO201
	BIO332	Anatomy and Physiology	해부및생리학	3-3-0	
1tr(R), 2tr(E)	BIO221	Biochemistry II	생화학 II	3-3-0	
	BIO261	Biochemistry Laboratory	생화학실험	2-0-4	
	BIO333	Genetics	유전학	3-3-0	1st track only, BIO201
Elective	BIO202	Molecular Biology Laboratory	분자생물학실험	2-0-4	
	BIO303	Neurobiology	신경생물학	3-3-0	
	BIO314	Instrumental Bioanalysis	생물기기분석	3-3-0	
	BIO316	Protein Science	단백질학	3-3-0	
	BIO331	Microbiology	미생물학	3-3-0	
	BIO361	Cell Biology & Genetics Laboratory	세포생물학 및 유전학실험	2-0-4	
	BIO404	Current Topics in Biological Sciences	현대생명과학동향	3-3-0	
	BIO412	Microbial Physiology	미생물생리학	3-3-0	BIO331
	BIO431	Bioinformatics	생물정보학	3-3-0	
	BIO432	Immunology	면역학	3-3-0	
	BIO433	Biochemistry of Signal Tranduction and Regulation	세포신호전달	3-3-0	
	BIO401	Special Topics in Biological Sciences I	생명과학특론 I	3-3-0	
	BIO402	Special Topics in Biological Sciences II	생명과학특론 II	3-3-0	
	BIO403	Special Topics in Biological Sciences III	생명과학특론 III	3-3-0	
	BME323	Biochemical Engineering	생물화학공학	3-3-0	
	BME413	Biomedical Instrumentation Laboratory	의료기기실험	3-1-4	
	BME431	Biomedical Imaging	의생명이미징	3-3-0	
	CHM211	Organic Chemistry I	유기화학 I	3-3-0	
	CHM212	Organic Chemistry II	유기화학 II	3-3-0	
	CHM231	Physical Chemistry I	물리화학 I	3-3-0	

▶ Recommended Course Tracks (BIO)

* : Required for 1st track and 2nd track, ** : Required only for 1st track, & : Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH103(Applied Linear Algebra) *BIO211(Biochemistry I) **BIO261(Biochemistry Laboratory) CHM211(Organic Chemistry I) CHM231(Physical Chemistry I)	&MTH211(Statistics) *BIO201(Molecular Biology) **BIO261(Biochemistry Laboratory) **BIO221(Biochemistry II) BIO202(Molecular Biology Laboratory) CHM212(Organic Chemistry II)	
3	*BIO301(Cell Biology) *BIO302(Developmental Biology) BIO314(Instrumental Bioanalysis) BIO361(Cell Biology & Genetics Laboratory) BIO331(Microbiology)	*BIO332(Anatomy and Physiology) **BIO333(Genetics) BIO303(Neurobiology) BIO316(Protein Science) BME323(Biochemical Engineering) BME413(Biomedical Instrumentation Laboratory)	
4	BIO432(Immunology) BIO412(Microbial Physiology) BIO433(Biochemistry of Signal Tranduction and Regulation) BIO404(Current Topics in Biological Sciences) BME411(Physical Biology of the Cell)	BIO431(Bioinformatics) BIO404(Current Topics in Biological Sciences) BME431(Biomedical Imaging)	

* It is mandatory that students whose 2nd track is Biological Sciences take all major courses chosen only from BIO code courses.
* NBC students must check for viable replacement courses according to the course replacement list before registration.

4. Course Descriptions

▶ Biomedical Engineering (BME)

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-world 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]

The objective of this course is to provide a fundamental understanding of various analysis tools and instruments in biomedical applications. This course will cover the basic principles of qualitative and quantitative analyses, including chromatography, spectroscopy, and biomedical imaging.

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.

BME301 Computational Methods for Biosciences and Bioengineering [생명과학생명공학전산]

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.

BME319 Optics and Imaging [광학이미징]

The objective of this course is to understand optical microscopy and tomography. The course will cover the fundamental optics including an overview of optical components and mechanics, and the principle of optical imaging techniques. Students will have an opportunity to design basic optical imaging system considering imaging parameters such as resolution, depth of focus, and field of view.

BME323 Biochemical Engineering [생물화학공학]

The purpose of this course is to engineer biological strategies to produce useful products and also to design bio-reactors in which biological organisms or molecules can be used. The course covers the basic application of biology and biochemistry to bio-reaction engineering.

BME411 Physical Biology of the Cell [세포생물물리학]

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.

BME435 Biomaterials and Tissue Engineering [바이오재료 및 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 Engineering 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.

▶ 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 [생화학 I]

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.

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.

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.

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.

BIO404 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.

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 [생물정보학]

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.

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.

School of Natural Science

1. School Introduction

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. All the faculty members in School of Natural Science are jointly appointed to engineering divisions and they recruit graduate students, fellows, and postdocs from both engineering and natural science backgrounds such as mathematics, physics, and chemistry. Thanks to this interdisciplinary system, all the researchers are systematically trained and naturally mingle in the environment of convergent research. From a practical point of view, such experiences with people from various backgrounds will be a big advantage for their research and future career.

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 'beyond atoms 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 conventional study on mathematical structures, the mathematical research at UNIST is devoted to encompass some of the most diverse and interdisciplinary research in the physical, engineering, and biological sciences. The department provides a dynamic and engaging research environment that is especially strong in scientific computing, mathematical biology and modern mathematical methods.
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)		
		1st Track	2nd Track	
Physics	Required	30	12	
	Elective	18	6	
Chemistry	Required	28	12	
	Elective	20	6	
Mathematical Sciences	Required	30	12	
	Elective	12	6	

☐ Fundamental Course for Each track

▶ Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Natural Science	Physics	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Chemistry	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2
	Mathematical Sciences	MTH103	Applied Linear Algebra	2-1
		MTH201	Differential Equations	2-2

▶ Required IT Courses

School	Programming	Practical IT	Designated course by the school		
			Track	Course No.	Title
School of Natural Science	Engineering Programming I	Engineering Programming II	Mathematical Sciences	MTH361	Mathematical Modeling and Applications

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

Course Title	School of Natural Science		
	PHY	CHEM	MTH
Calculus I	A	A	A
Calculus II	R	O	R
Applied Linear Algebra	A	A	A
Differential Equations	R	O	R
Statistics	–	O	O
General Physics I	R	A	A
General Physics II	R	O	O
General Chemistry I	O	A	A
General Chemistry II	O	R	O
General Physics Lab I	R	O	O
General Physics Lab II	R	O	O
General Chemistry Lab I	O	R	O
General Chemistry Lab II	O	R	O

R : Required A : Accepted O : Optional

3. Curriculum

☐ PHYSICS (PHY)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	PHY201	Classical Mechanics	고전역학	3-3-0	PHY101, PHY103
	PHY203	Electromagnetism I	전자기학 I	3-3-0	PHY101, PHY103
	PHY301	Quantum Physics I	양자물리학 I	3-3-0	PHY101, PHY103
	PHY303	Thermal and Statistical Physics	열 및 통계물리학	3-3-0	PHY101, PHY103
1TR:R 2TR:E	PHY204	Electromagnetism II	전자기학 II	3-3-0	PHY203
	PHY207	Physics Lab I	물리학실험 I	3-1-4	PHY101, PHY103, PHY106
	PHY211	Mathematical Physics I	수리물리학 I	3-3-0	
	PHY213	Modern Physics	현대물리학	3-3-0	PHY101, PHY103
	PHY302	Quantum Physics II	양자물리학 II	3-3-0	PHY301
	PHY307	Physics Lab II	물리학실험 II	3-1-4	PHY101, PHY103, PHY106
	PHY221	Introduction to Computational Physics	전산물리학 입문	3-2-2	
	PHY312	Mathematical Physics II	수리물리학 II	3-3-0	PHY211
	PHY315	Solid State Physics	고체물리학	3-3-0	PHY301
	PHY321	Optics	광학	3-3-0	PHY204
	PHY333	Introduction to Astrophysics	천체물리학 입문	3-3-0	
	PHY407	Precision Measurements in Physics	정밀전자계측론	3-1-4	
	PHY416	Semiconductor Physics	반도체물리학	3-3-0	PHY315
	PHY417	Cryogenics and Superconductivity	초저온 및 초전도 물리학	3-3-0	PHY315
	PHY418	Polymer and Soft Matter Physics	고분자 및 연성물질물리학	3-3-0	PHY303
	PHY419	Phase Transition and Critical Phenomena	상전이와 임계현상	3-3-0	PHY303
	PHY423	Computational Physics	전산물리학	3-3-0	PHY221

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	PHY425	Atomic and Molecular Physics	원자 및 분자물리학	3-3-0	
	PHY427	Introduction to Plasma Physics	플라즈마 물리학 입문	3-3-0	
	PHY429	Nuclear & Elementary Particle Physics	핵 및 입자물리학	3-3-0	
	PHY431	General Relativity & Cosmology	일반상대론 및 우주론	3-3-0	
	PHY435	Biological Physics	생물물리학	3-3-0	
	PHY437	Nonlinear Dynamics	비선형동역학	3-3-0	
	PHY439	Introduction to Modern Theoretical Physics	현대이론물리학 입문	3-3-0	PHY312
	PHY471	Special Topics in Physics I	물리학 특강 I	3-3-0	
	PHY472	Special Topics in Physics II	물리학 특강 II	3-3-0	
	PHY473	Special Topics in Physics III	물리학 특강 III	3-3-0	
	CHM335	Molecular Structure and Dynamics	분자구조 및 동력학	3-3-0	
	MTH251	Mathematical Analysis I	해석학 I	3-3-0	
	MTH311	Complex Analysis	복소해석학	3-3-0	
	MTH451	Advanced Linear Algebra	고급선형대수학	3-3-0	
	MTH312	Fourier Analysis	푸리에 해석학	3-3-0	
	MEN220	Fluid Mechanics	유체역학	3-3-0	
	NSE427	Fundamentals of Nuclear Fusion	핵융합개론	3-3-0	
	AMS431	Magnetic Properties of Materials	재료의 자기적 성질	3-3-0	
	AMS230	Introduction to Crystallography	결정학개론	3-3-0	
	BME411	Physical Biology of the Cell	세포생물물리학	3-3-0	
	EE201	Basic Circuit Theory	회로이론	3-3-0	
	EE432	Optoelectronics	광전자공학	3-3-0	
	EE403	Introduction to RF Engineering	RF 공학 개론	3-3-0	
	CSE332	Theory of Computation	계산 이론	3-3-0	

▶ Recommended Course Tracks (PHY)

* : Required Course, ** : Required only for 1st track

Year/Sem.	I (Spring)	II (Fall)	Remark
2	MTH103 (Applied Linear Algebra) *PHY201 (Classical Mechanics) *PHY203 (Electromagnetism I) **PHY213 (Modern Physics) PHY221 (Introduction to Computational Physics)	MTH201 (Differential Equations) **PHY204 (Electromagnetism II) **PHY207 (Physics Lab I) **PHY211 (Mathematical Physics I)	
3	*PHY301 (Quantum Physics I) **PHY307 (Physics Lab II) PHY312 (Mathematical Physics II) PHY333 (Introduction to Astrophysics)	**PHY302 (Quantum Physics II) *PHY303 (Thermal and Statistical Physics) PHY315 (Solid State Physics) PHY321 (Optics)	
4	PHY407 (Precision Measurements in Physics) PHY416 (Semiconductor Physics) PHY417 (Cryogenics and Superconductivity) PHY419 (Phase Transition and Critical Phenomena) PHY425 (Atomic and Molecular Physics) PHY435 (Biological Physics) PHY439 (Introduction to Modern Theoretical Physics) PHY471 (Special Topics in Physics I)	PHY418 (Polymer and Soft Matter Physics) PHY423 (Computational Physics) PHY427 (Introduction to Plasma Physics) PHY429 (Nuclear & Elementary Particle Physics) PHY431 (General Relativity & Cosmology) PHY437 (Nonlinear Dynamics) PHY472 (Special Topics in Physics II) PHY473 (Special Topics in Physics III)	

▶ Replacement Courses (for students in second grade or over)

When students change the track to Physics from DPH, each course listed on the right can be substituted with each course listed on the left.

Courses for Physics Track			Replacement Courses	
Course is	Course No.	Course Title	Course No.	Course Title
Required	PHY201	Classical Mechanics	PHY501	Classical Mechanics
	PHY203	Electromagnetism I	DPH201	Electromagnetics I
	PHY301	Quantum Physics I	DPH303	Quantum mechanics I
	PHY303	Thermal and Statistical Physics	DPH305	Thermal and statistical physics
	PHY204	Electromagnetism II	DPH202	Electromagnetics II
	PHY207	Physics Lab I	CSE201	Digital System Lab
1TR:R 2TR:E	PHY211	Mathematical Physics I	–	–
	PHY213	Modern Physics	MSE250	Modern Physics of Materials
Elective	PHY302	Quantum Physics II	DPH304	Quantum mechanics II
	PHY307	Physics Lab II	–	–
	PHY221	Introduction to Computational Physics	–	–
	PHY312	Mathematical Physics II	PHY500	Advanced Mathematical Physics
	PHY315	Solid State Physics	DPH401	Solid state physics
	PHY321	Optics	–	–
	PHY333	Introduction to Astrophysics	–	–
	PHY423	Computational Physics	PHY541	Computational Physics

(The track-required and elective courses of the DPH track not specified in the table above are acknowledged as elective courses of the Physics track.)

□ Chemistry (CHEM)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	CHM211	Organic Chemistry I	유기화학 I	3-3-0	
	CHM212	Organic Chemistry II	유기화학 II	3-3-0	
	CHM231	Physical Chemistry I	물리화학 I	3-3-0	
	CHM232	Physical Chemistry II	물리화학 II	3-3-0	
	CHM291	Analytical Chemistry I	분석화학 I	3-3-0	
	CHM321	Biochemistry I	생화학 I	3-3-0	
	CHM351	Inorganic Chemistry I	무기화학 I	3-3-0	
	CHM391	Instrumental Analysis	기기분석	3-3-0	
	CHM201	Organic Chemistry Laboratory I	유기화학실험 I	2-0-4	
	CHM202	Physical/Analytical Chemistry Laboratory	물리분석화학실험	2-0-4	
Elective	CHM301	Inorganic Chemistry Laboratory	무기화학실험	2-0-4	
	CHM311	Synthetic Organic Chemistry	합성유기화학	3-3-0	
	CHM313	Fundamental of Energy Materials	에너지재료개론	3-3-0	
	CHM322	Biochemistry II	생화학 II	3-3-0	
	CHM333	Physical Chemistry III	물리화학 III	3-3-0	
	CHM335	Molecular Structure and Dynamics	분자구조 및 동력학	3-3-0	
	CHM352	Inorganic Chemistry II	무기화학 II	3-3-0	
	CHM371	Introduction to Nanochemistry	나노화학개론	3-3-0	
	CHM372	Introduction to Polymer Chemistry	고분자화학개론	3-3-0	
	CHM421	Introduction to Chemical Biology	화학생물학개론	3-3-0	
	CHM422	Supramolecular Chemistry	초분자화학	3-3-0	
	CHM423	Medicinal Chemistry	의약화학	3-3-0	CHM211, CHM212
	CHM431	Frontier Spectroscopy	첨단 분광학	3-3-0	
	CHM451	Inorganic Materials Analysis	무기재료분석	3-3-0	
	CHM452	Organometallic Chemistry	유기금속화학	3-3-0	
	CHM453	Bioinorganic Chemistry	생무기화학	3-3-0	
	CHM454	Solid State Chemistry	고체화학	3-3-0	
	CHM471	Block Copolymers	블록 코폴리머	3-3-0	
	CHM473	Nanomaterials Chemistry	나노재료화학	3-3-0	
	CHM401	Special Topics in Chemistry I	화학특론 I	3-3-0	
	CHM402	Special Topics in Chemistry II	화학특론 II	3-3-0	
	CHM403	Special Topics in Chemistry II	화학특론 III	3-3-0	

▶ Recommended Course Tracks (CHEM)

* : Required Courses, ** : Required only for 1st track, & : Required Math

Year/Sem.	I (Spring)	II (Fall)	Remark
2	&MTH103(Applied Linear Algebra) *CHM211(Organic Chemistry I) *CHM231(Physical Chemistry I) *CHM291(Analytical Chemistry I)	&MTH201(Differential Equations) *CHM232(Physical Chemistry II) *CHM212(Organic Chemistry II) **CHM201(Organic Chemistry Laboratory I)	
3	*CHM231(Biochemistry I) *CHM351(Inorganic Chemistry I) *CHM391(Instrumental Analysis) CHM333(Physical Chemistry III) CHM311(Synthetic Organic Chemistry) CHM313(Fundamental of Energy Materials) CHM335(Molecular Structure and Dynamics)	**CHM202(Physical/Analytical Chemistry Laboratory) CHM352(Inorganic Chemistry II) CHM322(Biochemistry II) CHM371(Introduction to Nanochemistry) CHM372(Introduction to Polymer Chemistry) CHM301(Inorganic Chemistry Laboratory)	
4	CHM454(Solid State Chemistry) CHM421(Introduction to Chemical Biology) CHM471(Block Copolymers) CHM452(Organometallic Chemistry)	CHM431(Frontier Spectroscopy) CHM422(Supramolecular Chemistry) CHM451(Inorganic Materials Analysis) CHM423(Medicinal Chemistry) CHM453(Bioinorganic Chemistry) CHM473(Nanomaterials Chemistry)	

* It is mandatory that students whose 1st track is Chemistry participate in their graduate research lab for 2 semesters.
* Students whose 2nd track is Chemistry must conform to the following guidelines:
  A. Required course: Choose four courses(minimum) among the listed required courses and designated them with "*".
  B. Elective course: Choose two courses(minimum) in the listed required and elective courses.
* NBC students must check for viable replacement courses according to the course replacement list before registration.

Mathematical Sciences (MTH)

Course is	Course No.	Course Title	Course Title(Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	MTH251	Mathematical Analysis I	해석학 I	3-3-0	
	MTH261	Modern Algebra I	현대대수학 I	3-3-0	
	MTH311	Complex Analysis	복소해석학	3-3-0	
	MTH351	General Topology	위상수학	3-3-0	
1TR:R 2TR:E	MTH252	Mathematical Analysis II	해석학 II	3-3-0	MTH251
	MTH301	Probability	확률론	3-3-0	
	MTH321	Numerical Analysis	수치해석학	3-3-0	
	MTH331	Differential Geometry I	미분기하학 I	3-3-0	
	MTH411	Ordinary Differential Equations	상미분방정식론	3-3-0	MTH201
	MTH421	Introduction to Partial Differential Equations	편미분방정식개론	3-3-0	MTH201
Elective	MTH230	Set theory	집합론	3-3-0	
	MTH260	Elementary Number theory	정수론	3-3-0	
	MTH262	Modern Algebra II	현대대수학 II	3-3-0	
	MTH271	Methods of Applied Mathematics	응용수학방법론	3-3-0	
	MTH281	Discrete Mathematics	이산수학	3-3-0	
	MTH312	Fourier Analysis	푸리에 해석학	3-3-0	
	MTH330	Introduction to Geometry	기하학 개론	3-3-0	
	MTH332	Differential Geometry II	미분기하학 II	3-3-0	
	MTH341	Mathematical Statistics	수리통계학	3-3-0	
	MTH352	Algebraic Topology	대수위상	3-3-0	
	MTH361	Mathematical Modeling and Applications	수리모형방법론	3-3-0	
	MTH412	Dynamical Systems	동적 시스템	3-3-0	
	MTH431	Scientific Computing	과학계산	3-3-0	
	MTH441	Financial Mathematics	금융수학	3-3-0	
	MTH451	Advanced Linear Algebra	고급선형대수학	3-3-0	MTH103
	MTH461	Stochastic Processes	확률과정론	3-3-0	
	MTH480	Topics in Mathematics I	수학 특강 I	3-3-0	
	MTH481	Topics in Mathematics II	수학 특강 II	3-3-0	

▶ Recommended Course Tracks (MTH)

* : Required Course, ** : Required only for 1st track

Year/Sem.	I (Spring)	II (Fall)	Remark
2	MTH103 *MTH251 MTH281 MTH271 *MTH311 MTH230	MTH201 **MTH252 MTH361 MTH260 MTH312	
3	**MTH301 **MTH331 *MTH261 MTH341 MTH352	**MTH321 *MTH351 MTH441 MTH332 MTH262	
4	**MTH411 MTH412 MTH451 MTH480	**MTH421 MTH461 MTH481 MTH431	

4. Course Descriptions

▶ Physics (PHY)

PHY201 Classical Mechanics [고전역학]

This course covers various aspects of the Newtonian mechanics, including kinematics, angular motion, gravity, collision, and oscillations. Elementary description of fluid and rigid bodies can be discussed. The course in part aims at training students with mathematical techniques for physics study. Variational principles and formulations of Lagrangians and Hamiltonians are introduced, and its connection to quantum mechanics and relativity is discussed.

PHY203 Electromagnetism I [전자기학 I]

This course is the first half of one-year electromagnetism 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.

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.

PHY211 Mathematical Physics I [수리물리학 I]

The subject of mathematical physics covers elementary introduction to mathematical tools that are required for the study of advanced physics subjects. As prerequisites, students are assumed to have mastered the elementary physics courses. The background in basic analysis and linear algebra is recommended but also is self-consistently treated during the course. Differential operators are discussed in terms of geometry; the analysis of complex variable is introduced with particular focus onto special functions that frequently appear in physics study. Variational principles and linear algebra including group representation are to be introduced briefly as a basis for the study of quantum mechanics.

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.

PHY221 Introduction to Computational Physics [전산물리학 입문]

This course aims for training the students in various elementary computational techniques necessary for numerical modelling of actual physics problems in the upper level courses. The subjects to be covered are basic linux commands, C, C++, fortran, mathematica, matlab, and methods of numerical analysis using those tools to solve elementary mathematics and physics problems. In addition to the regular class hours, participating the lab two hours every week is mandatory.

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.

PHY312 Mathematical Physics II [수리물리학 II]

This course is a continuation of the Mathematical Physics (PHY211) and aims at training students with advanced level of mathematical method, including tensor analysis, integral transforms, calculus of variations, integral equations, and group theory. This course focuses on mathematical description of physical problem rather than emphasizing mathematical rigour, thus example problems in classical mechanics and quantum mechanics are to be discussed. As prerequisites, students are assumed to have mastered the general physics and classical mechanics, and studied basic introduction to quantum mechanics. The background of mathematics at the level of "Mathematical Physics" is also strongly required.

PHY315 Solid State Physics [고체물리학]

As an introductory course to solid state physics, this course covers crystal structure, lattice vibration, free electron theory in metals, the quantum electron theory and the concept of band theory, electron transport in metal/semiconductor/insulator, dielectric and magnetic properties of materials, and superconducting materials.

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 [천체물리학 입문]

In astrophysics, various astronomical phenomena are explained by knowledges of various fields in physics. This course introduces some astronomical phenomena in topical fashion such as stellar evolution, interstellar medium, galaxies, neutron stars and related X-ray observations, and more. Physical processes, in particular, theoretical understandings that explain the Introduced astronomical phenomena are covered.

PHY407 Precision Measurements in Physics [정밀전자계측론]

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.

PHY416 Semiconductor Physics [반도체물리학]

As one of the specialized topics of condensed matter physics, this course is designed to discuss the fundamental physics of semiconductor materials and devices at post-introductory level. It covers semiconducting crystals, energy bands and density of states, doping and carrier concentration, semiclassical approaches for carrier transport, Fermi Golden Rule and optical processes, and interfaces in semiconductor devices. Quantum transport at low-dimensional systems will also be introduced as a more advanced subject.

PHY417 Cryogenics and Superconductivity [초저온 및 초전도 물리학]

As one of the specialized topics of condensed matter physics, this course is intended to discuss the basics of low-temperature physics and unique collective quantum phenomena occurring in condensed matter systems such as superfluidity and superconductivity. Topics include the experimental techniques for low-temperature physics, helium superfluid, electrodynamics of superconductor, BCS theory, Ginzburg-Landau theory, type-II superconductor, and Josephson effect. The brief introduction to high-temperature superconductor will be also given as a more advanced subject.

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.

PHY419 Phase Transition and Critical Phenomena [상전이와 임계현상]

This course is designed as an advanced sequel to Thermal and Statistical Physics (PHY303) with focus on the emergent properties of many-body systems. Mean-field theory of continuous and first-order phase transitions, Landau-Ginzburg phenomenology, spontaneous symmetry breaking, correlation functions, and the roles of fluctuations will be briefly covered in connection to the key concepts of scaling and universality classes. Selected topics for the (optional) term project will include not only the condensed matter systems but also diverse interdisciplinary subjects found in biology, economics, social sciences, and the studies of complex systems.

PHY423 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.

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.

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.

PHY471~3 Special Topics in PHY Ⅰ ~ Ⅲ [물리학특강 Ⅰ ~ Ⅲ]

This course introduces new research topics in the field of Physics.

▶ Chemistry (CHEM)

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.

CHM201 Organic Chemistry Laboratory I [유기화학실험 I]

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.

CHM202 Physical/Analytical Chemistry Laboratory [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.

CHM301 Inorganic Chemistry Laboratory [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.

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 1 [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.

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 Molecular Structure and Dynamics [분자구조 및 동력학]

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.

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 Supramolecular Chemistry [초분자화학]

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.

CHM423 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.

CHM431 Frontier Spectroscopy [첨단분광학]

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.

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.

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.

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)

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.

MTH261 Modern Algebra I [현대대수학 I]

Groups, homomorphisms, automorphisms, permutation groups. Rings, ideals and quotient rings, Euclidean rings, polynomial rings. Extension fields, roots of polynomials.

MTH262 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.

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.

MTH301 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.

MTH311 Complex Analysis [복소해석학]

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. Conformal mapping: Fractional Linear transformations. Riemann Mapping Theorem. Analytic continuation. Harmonic functions.

MTH312 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.

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 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.

MTH332 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.

MTH341 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.

MTH352 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.

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.

MTH411 Ordinary Differential Equations [상미분방정식론]

Existence and uniqueness of solutions, linear systems, regular singular points. Analytic systems, autonomous systems, Sturm-Liouville Theory.

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.

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.

MTH431 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.

MTH441 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.

MTH451 Advanced Linear Algebra [고급선형대수학]

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.

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 School of Business Administration educates students both in technology and management to be creative global business leaders in today's dynamic economy.
The School offers academic courses on various business areas including Technology Management, Information Systems, Finance, International Business, Marketing and Entrepreneurship.

2. Undergraduate Programs

□ Track Introduction

1) Management (MGT)

Management field aims to provide education for the leaders in a highly globalized and diversified playing field with rapid technological and social changes.
GM track manor explores an organization's design and operations; an organization's economic, legal, ethical and sociopolitical environment; how an organization interacts with its environment in a creative and efficient way.

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.

Credit Requirement

Track	Required/Elective	Credit(minimum)	
		1st Track	2nd Track
Management(MGT)	Required	33	18
	Elective	15	–
Finance & Accounting(FIA)	Required	27	18
	Elective	21	–

* School of Business Administration students who choose both tracks should take 11 required courses from track of Management and 2 required courses from FIA .
* The overlapping courses of FIA and MGT will be approved for one department only and elective courses should be taken among the offered courses by School of Business Administration.

Fundamental Course for Each track

▶ Required Mathematics Course for Each Track

School	Track	Course No.	Required Mathematics course	Semester
School of Business Administration	Management	MTH103	Applied Linear Algebra	1–2
		MTH211	Statistics	1–2
	Finance & Accounting	MTH103	Applied Linear Algebra	1–2
		MTH211	Statistics	1–2

▶ Required IT Courses

School	Programming	Practical IT
School of Business Administration	Business Programming	Business IT

▶ Fundamentals required to ENG field students when they choose MGT field tracks

Course Title	School of Business Administration	
	MGT	FIA
Innovation and Entrepreneurship	R	R
Economics	R	R

R : Required A : Accepted O : Optional

Recommended Course Schedules

▶ Math&Science : Applied Linear Algebra(MTH103), Statistics(MTH211)

Year/Sem.	I (Spring)	II (Fall)	Remark
1		MTH103 MTH211	

▶ MGT IT Courses : Business IT(ISM202), Business Programming(ITP108)

Year/Sem.	I (Spring)	II (Fall)	Remark
1	ISM202 ITP108	ISM202 ITP108	

▶ MGT : Innovation & Entrepreneurship(MGT102), Economics(MGT106)

Year/Sem.	I (Spring)	II (Fall)	Remark
1	MGT102 MGT106	MGT102	

3. Curriculum

□ Management (MGT)

Course is	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite
Required	MGT202	Organizational Behavior	조직행동론	3-3-0	
	MGT204	Marketing Management	마케팅 관리	3-3-0	
	MGT205	Financial Accounting	재무회계	3-3-0	
	MGT207	Financial Management	재무관리	3-3-0	
	MGT209	Operations Management	생산관리	3-3-0	
	MGT308	Strategic Management	경영전략	3-3-0	
1TR : R 2TR : E	MGT101	Leadership and Teamwork	리더십과 팀워크	3-3-0	
	MGT201	Dynamics of IT	Dynamics of IT	3-3-0	
	MGT206	Managerial Accounting	관리회계	3-3-0	MGT205
	MGT210	Data Analysis & Decision Making	경영통계 분석	3-3-0	MTH211
	MGT211	Microeconomics	미시경제학	3-3-0	MGT106
	MGT203	International Business	국제 경영	3-3-0	
	MGT302	Human Resource Management	인사관리	3-3-0	MGT202
	MGT306	Business Ethics	기업경영 윤리	3-3-0	
	MGT307	Legal Environment of Business	경영과 법률환경	3-3-0	
	MGT312	Macroeconomics	거시경제학	3-3-0	MGT211
	MGT315	Econometrics	계량경제학	3-3-0	MGT211 MTH211
	MGT316	Industrial Organization	산업조직론	3-3-0	MGT211
	MGT317	International Economics	국제경제학	3-3-0	MGT211 MGT312
	MGT318	International Finance	국제재무관리	3-3-0	
	MGT330	Consumer Behavior	소비자행동론	3-3-0	
	MGT331	International Marketing	국제마케팅	3-3-0	MGT204
	MGT332	Brand Management	브랜드관리론	3-3-0	MGT330
	MGT361	Technology Management	기술 경영	3-3-0	
	MGT362	Process & Quality Management	생산과 품질 관리	3-3-0	MGT209
	MGT363	Operations Research	계량경영학	3-3-0	
	MGT364	Database	데이터 베이스	3-3-0	ISM202

Course is	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite
Elective	MGT366	Advanced Business Programming	고급 경영 프로그래밍	3-3-0	ITP108
	MGT372	Internet Business and Marketing	인터넷 비즈니스	3-3-0	
	MGT373	Strategic Management of IT	정보기술과 경영전략	3-3-0	MGT308, ISM201
	MGT374	Mobile Business	모바일 비즈니스	3-3-0	
	MGT410	Special Topics in MGT I	MGT 특론 I	3-3-0	
	MGT411	Special Topics in MGT II	MGT 특론 II	3-3-0	
	MGT413	Game Theory	게임 이론	3-3-0	MGT211
	MGT432	Marketing Research	마케팅 조사론	3-3-0	MGT204
	MGT433	Advertising Management	광고관리론	3-3-0	MGT204
	MGT434	Experimental Design with Applications in Marketing	마케팅실험설계	3-3-0	MGT330
	MGT435	Case Studies in Marketing	마케팅사례연구	3-3-0	
	MGT441	Global Business Strategy	글로벌경영전략	3-3-0	
	MGT442	Case Studies in International Business	국제경영사례연구	3-3-0	
	MGT463	Simulation	시뮬레이션		MTH211
	MGT464	Stochastic Modeling & Applications	추계적 모델링 및 응용	3-3-0	MTH211
	MGT465	System Analysis and Design	경영정보시스템분석 및 설계	3-3-0	
	MGT466	Data Mining	데이터 마이닝	3-3-0	ISM202
	MGT471	Managing innovation and Change	혁신과 변화의 관리	3-3-0	
	MGT473	Entrepreneurship and Venture Management	창업과 벤처	3-3-0	
	MGT491	Independent Study	개별연구	3-3-0	
	MGT492	Capstone Projects I	캡스톤 디자인 I	3-3-0	
	MGT493	Capstone Projects II	캡스톤 디자인 II	3-3-0	

▶ Recommended Course Tracks (MGT)

* : Required Course, ** : Required only for 1st track, # : IT course (designated course by the school)

Year/Sem.	I (Spring)	II (Fall)	Remark
2	#ISM202 **MGT101 **MGT201 *MGT204 *MGT206 *MGT207	**MGT101 **MGT201 *MGT202 *MGT209 *MGT210 *MGT211	* MGT205 Recommended to complete freshman.
3	*MGT208 MGT312 MGT372 MGT375	MGT302 MGT318 MGT330 MGT361 MGT363	
4	MGT436	MGT432 MGT464	

□ Finance & Accounting (FIA)

Course is	Course No.	Course Title	Course Title (Kor.)	Cred.–Lect.–Exp.	Prerequisite
Required	MGT205	Financial Accounting	재무회계	3–3–0	
	MGT206	Managerial Accounting	관리회계	3–3–0	MGT205
	MGT207	Financial Management	재무관리	3–3–0	
	MGT210	Data Analysis &Decision Making	경영통계 분석	3–3–0	MTH211
	MGT211	Microeconomics	미시경제학	3–3–0	MGT106
	FIA301	Investments	투자론	3–3–0	MGT210 MGT207
1TR : R 2TR : E	MGT101	Leadership and Teamwork	리더십과 팀워크	3–3–0	
	MGT201	Dynamics of IT	Dynamics of IT	3–3–0	
	FIA321	Intermediate Accounting I	중급회계 I	3–3–0	MGT205
Elective	MGT306	Business Ethics	기업경영윤리	3–3–0	
	MGT307	Legal Environment of Business	경영과 법률환경	3–3–0	
	MGT312	Macroeconomics	거시경제학	3–3–0	MGT211
	MGT315	Econometrics	계량경제학	3–3–0	MGT211
	MGT318	International Finance	국제재무관리	3–3–0	MGT207
	MGT473	Entrepreneurship and Venture Management	창업과 벤처	3–3–0	
	MGT491	Independent Study	개별연구	3–3–0	
	FIA302	Money and Banking	금융시장론	3–3–0	MGT207
	FIA303	Futures and Options	선물과 옵션	3–3–0	MGT207
	FIA322	Intermediate Accounting II	중급회계 II	3–3–0	MGT205 MGT206
	FIA401	Financial Engineering	금융공학	3–3–0	MGT207 FIA303
	FIA402	Fixed Income Securities	채권투자	3–3–0	MGT207
	FIA403	Derivatives Market	파생상품시장	3–3–0	MGT207, FIA303
	FIA404	Risk Management	리스크관리	3–3–0	MGT207 FIA303
	FIA405	Security Valuation	기업가치평가	3–3–0	MGT205 MGT207
	FIA406	Corporate Finance	기업재무론	3–3–0	MGT207
	FIA407	Case Studies in Finance	재무사례연구	3–3–0	MGT207
	FIA410	Special Topics in FIA I	FIA 특론 I	3–3–0	
	FIA411	Special Topics in FIA II	FIA 특론 II	3–3–0	
	FIA412	Special Topics in FIA III (Accounting)	FIA 특론 III (회계)	3–3–0	
	FIA441	Financial Statement Analysis	재무제표분석	3–3–0	MGT205
	FIA442	Taxation	세무회계	3–3–0	MGT205
	FIA443	Strategic Cost Management	원가관리전략	3–3–0	MGT206
	FIA445	Auditing	감사학개론	3–3–0	MGT205
	FIA492	Capstone Projects I	캡스톤 디자인 I	3–3–0	
	FIA493	Capstone Projects II	캡스톤 디자인 II	3–3–0	

▶ Recommended Course Tracks (FIA)

* : Required Course, ** : Required only for 1st track, # : IT course (designated course by the school)

Year/Sem.	I (Spring)	II (Fall)	Remark
2	#ISM202 **MGT101 **MGT201 *MGT206 *MGT207	**MGT101 **MGT201 *MGT211	* MGT205 Recommended to complete freshman.
3	*FIA301 *FIA321	*FIA303 FIA302 FIA322 FIA325	
4	FIA406 FIA407	FIA410 FIA411 FIA445	

4. Course Descriptions

▶ Management (MGT)

MGT101 Leadership and Teamwork [리더십과 팀워크]

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 [생산관리]

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.

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 [경영과법률 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.

MGT316 Industrial Organization [산업조직론]

Industrial organization is concerned with the workings of markets and industries, in particular the way firms compete with each other. Its emphasis is on the study of the firm strategies that are characteristic of market interaction: price competition, product positioning, advertising, research and development, and so forth.

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.

MGT318 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.

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 비즈니스]

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.

MGT374 Mobile Business [모바일비즈니스]

By taking a journey into the history of mobile technologies/services and their current trends, this course investigates how mobile technologies have transformed and will continue to transform the world. The course explores various mobile technologies, their business applications, successful and failed cases, and related issues such as mobile policy or convergence among wired, wireless, and broadcasting services.

MGT410, 411 Special Topics in MGT Ⅰ ~ Ⅱ [MGT 특론 Ⅰ ~ 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.

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.

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

MGT434 Experimental Design with Applications in Marketing [마케팅실험설계]

This course teaches the principles of experimental design for the study of consumer behavior. Experiments may be administered through surveys and on the Internet as well as in laboratory settings. The goal of this course is to become familiar with experimental research techniques and data analysis. Specifically, we will discuss various experimental designs, how to manipulate independent variables and measure dependent variables, how to control for the influence of extraneous variables, and how to eliminate alternative hypotheses. Further, we will discuss the methods to statistically analyze data obtained from experimental research (e.g., analysis of variance, regression), and the specific problems that can occur when analyzing the experimental data.

MGT435 Case Studies in Marketing [마케팅사례연구]

This course helps students understand the subjects in Marketing, and gives opportunities to discuss the managerial and academic issues through practical cases in Marketing.

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.

MGT442 Case Studies in International Business [국제경영사례연구]

This course helps students understand the subjects in International Business within a globalized economy, and gives opportunities to discuss the managerial and academic issues through practical cases in 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.

MGT466 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.

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 prepares students to understand practical business cases.

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.

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)

MGT101 Leadership and Teamwork [리더십과 팀워크]

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

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.

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.

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 법률환경]

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.

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.

MGT318 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.

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.

FIA301 Investment Analysis [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 Options [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.

FIA321 Intermediate Accounting I [중급회계 I]

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 [중급회계 II]

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.

FIA401 Financial Engineering [금융공학]

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.

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.

FIA403 Derivatives Market [파생상품 시장]

This course covers advanced topics in derivative security markets. The purpose of the course is to provide students with comprehensive theories in derivative securities and practical issues in complicated derivative markets. It includes the quantitative valuations, technical properties and applications, hedging and trading strategies of basic and exotic derivatives. Futures and Options (FIA303) is a prerequisite for this course.

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 Security 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.

FIA406 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 anagement” 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.

FIA407 Case Studies in Finance [재무사례연구]

This course is designed to apply the theories of financial management to the practical business cases faced by corporations and financial institutions. Students will have opportunities to practice the problems of capital structure, capital budgeting, valuation of financial assets, and risk management.

FIA410~2 Special Topics in FIA I ~ III [FIA 특론 I ~ III]

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.

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 Strategic Cost Management [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.

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.

[Appendix] Alternative Curriculum for 2013 curriculum

□ Mechanical System Design and Manufacturing [SDM] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	SDM230	Solid Mechanics Ⅰ	MEN230	Solid Mechanics Ⅰ
	SDM231	Solid Mechanics Ⅱ	MEN231	Solid Mechanics Ⅱ
	SDM270	Dynamics	MEN270	Dynamics
	SDM351	Machine Element Design	MEN351	Machine Element Design
	SDM490	Interdisciplinary Project	P/F	
	TFP210	Thermodynamics	MEN210	Thermodynamics
	TFP220	Fluid Mechanics	MEN220	Fluid Mechanics
	TFP300	Mechanical Engineering Lab	MEN300	Mechanical Engineering Lab
Elective	SDM250	Mechanical Drawing and Lab	MEN250	Mechanical Drawing and Lab
	SDM302	Introduction to Finite Element Method	MEN302	Introduction to Finite Element Method
	SDM350	Manufacturing Processes and Lab	MEN350	Manufacturing Processes and Lab
	SDM352	Creative Engineering Design Ⅰ	MEN352	Creative Engineering Design Ⅰ
	SDM370	Dynamic Systems and Control	MEN370	Dynamic Systems and Control
	SDM431	Introduction to Plastic Deformation	MEN431	Introduction to Plastic Deformation
	SDM451	Introduction to MEMS	MEN451	Introduction to MEMS
	SDM452	Creative Engineering Design Ⅱ	MEN452	Creative Engineering Design Ⅱ
	SDM453	Computer Aided Engineering	MEN453	Computer Aided Engineering
	SDM454	Optimal Design	MEN454	Optimal Design
	SDM461	Introduction to Robotics	MEN461	Introduction to Robotics
	SDM462	Introduction to Biomechanics	MEN462	Introduction to Biomechanics
	SDM470	Mechanical Vibration	MEN470	Mechanical Vibration
	SDM472	Introduction to Sensors	MEN472	Introduction to Sensors
	SDM473	Acoustics	MEN473	Acoustics
	SDM497	Special Topics in Mechanical System Design and Manufacturing Ⅰ	Remove	
	SDM498	Special Topics in Mechanical System Design and Manufacturing Ⅱ	Remove	
	SDM499	Special Topics in Mechanical System Design and Manufacturing Ⅲ	Remove	
	TFP211	Applied Thermodynamics	MEN211	Applied Thermodynamics
	TFP301	Numerical Analysis	MEN301	Numerical Analysis
	TFP310	Heat Transfer	MEN310	Heat Transfer
	TFP311	Internal Combustion Engine	MEN311	Internal Combustion Engine
	TFP312	Mechatronics and Thermofluid Control	MEN312	Mechatronics and Thermofluid Control
	TFP320	Applied Fluid Mechanics	MEN320	Applied Fluid Mechanics
	TFP411	Combustion	MEN411	Combustion
	TFP412	Air-Conditioning and Refrigeration	MEN412	Air-Conditioning and Refrigeration
	TFP455	Multiscale System Design	MEN455	Multiscale System Design
	TFP456	Energy System Design	MEN456	Energy System Design
	TFP457	Introduction to Electric-Electronic Engineering	MEN457	Introduction to Electric-Electronic Engineering

□ Thermo-Fluid and Power Engineering [TFP] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	TFP210	Thermodynamics	MEN210	Thermodynamics
	TFP220	Fluid Mechanics	MEN220	Fluid Mechanics
	TFP300	Mechanical Engineering Lab	MEN300	Mechanical Engineering Lab
	TFP310	Heat Transfer	MEN310	Heat Transfer
	TFP320	Applied Fluid Mechanics	MEN320	Applied Fluid Mechanics
	TFP490	Interdisciplinary Project	P/F	
	SDM230	Solid Mechanics I	MEN230	Solid Mechanics I
	SDM231	Solid Mechanics II	MEN231	Solid Mechanics II
	SDM270	Dynamics	MEN270	Dynamics
Elective	TFP211	Applied Thermodynamics	MEN211	Applied Thermodynamics
	TFP301	Numerical Analysis	MEN301	Numerical Analysis
	TFP311	Internal Combustion Engine	MEN311	Internal Combustion Engine
	TFP312	Mechatronics and Thermofluid Control	MEN312	Mechatronics and Thermofluid Control
	TFP411	Combustion	MEN411	Combustion
	TFP412	Air-Conditioning and Refrigeration	MEN412	Air-Conditioning and Refrigeration
	TFP455	Multiscale System Design	MEN455	Multiscale System Design
	TFP456	Energy System Design	MEN456	Energy System Design
	TFP457	Introduction to Electric-Electronic Engineering	MEN457	Introduction to Electric-Electronic Engineering
	TFP497	Special Topics in Thermo-Fluid and Power Engineering I	Remove	
	TFP498	Special Topics in Thermo-Fluid and Power Engineering II	Remove	
	TFP499	Special Topics in Thermo-Fluid and Power Engineering III	Remove	
	SDM250	Mechanical Drawing and Lab	MEN250	Mechanical Drawing and Lab
	SDM302	Introduction to Finite Element Method	MEN302	Introduction to Finite Element Method
	SDM350	Manufacturing Processes and Lab	MEN350	Manufacturing Processes and Lab
	SDM351	Machine Element Design	MEN351	Machine Element Design
	SDM352	Creative Engineering Design I	MEN352	Creative Engineering Design I
	SDM370	Dynamic Systems and Control	MEN370	Dynamic Systems and Control
	SDM431	Introduction to Plastic Deformation	MEN431	Introduction to Plastic Deformation
	SDM451	Introduction to MEMS	MEN451	Introduction to MEMS
	SDM452	Creative Engineering Design II	MEN452	Creative Engineering Design II
	SDM453	Computer Aided Engineering	MEN453	Computer Aided Engineering
	SDM454	Optimal Design	MEN454	Optimal Design
	SDM461	Introduction to Robotics	MEN461	Introduction to Robotics
	SDM462	Introduction to Biomechanics	MEN462	Introduction to Biomechanics
	SDM470	Mechanical Vibration	MEN470	Mechanical Vibration
	SDM472	Introduction to Sensors	MEN472	Introduction to Sensors
	SDM473	Acoustics	MEN473	Acoustics

□ Environmental Analysis and Control Engineering [PCE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	PCE201	Introduction to Environmental Engineering	ESE201	Introduction to Environmental Engineering
Required	PCE203	Water Pollution	ESE204	Water Pollution
Required	ESE201	Environmental Chemistry	ESE202	Environmental Chemistry
Required	PCE490	Interdisciplinary Project		
IT course	DRE321	Numerical Modeling and Analysis	DME321	Numerical Modeling and Analysis
Elective	PCE202	Air Pollution	ESE205	Air Pollution
Elective	BEN231	Microbiology	BME231	Microbiology
Elective	NCS251	Physical Chemistry I	CHM231	Physical Chemistry I
Elective	NCS252	Physical Chemistry II	CHM232	Physical Chemistry II
Elective	NCS201	Organic Chemistry I	CHM211	Organic Chemistry I
Elective	NCS231	Organic Chemistry II	CHM212	Organic Chemistry II
Elective	TFP220	Fluid Mechanics	MEN220	Fluid Mechanics
Elective	PCE301	Water Treatment Engineering	ESE311	Water Treatment Engineering
Elective	PCE302	Soil Pollution	ESE312	Soil Pollution
Elective	PCE303	Aquatic Chemistry Laboratory	ESE313	Aquatic Chemistry Laboratory
Elective	ESE301	Environmental Impact Assessment	ESE336	Environmental Impact Assessment
Elective	ESE302	Analysis of Pollutant	ESE331	Analysis of Pollutant
Elective	ACE232	Transport Phenomena	ACE331	Transport Phenomena I
Elective	TFP320	Applied Fluid Mechanics	MEN320	Applied Fluid Mechanics
Elective	NCS301	Instrumental Analysis	CHM391	Instrumental Analysis
Elective			ACE391	Instrumental Analysis
Elective	ACE311	Chemical Reaction Engineering	ACE311	Chemical Reaction Engineering
Elective	ACE332	Transport Phenomena II	ACE332	Transport Phenomena II
Elective	PCE401	Water and Wastewater Engineering	ESE411	Water and Wastewater Engineering
Elective	PCE402	Environmental Remediation	ESE412	Environmental Remediation
Elective	PCE403	Wastes Management	ESE413	Wastes Management
Elective	PCE404	Environmental Bioprocess	ESE414	Environmental Bioprocess
Elective	PCE405	Environmental Toxicology	ESE415	Environmental Toxicology
Elective	PCE406	Special Topics in Pollution Control Engineering I	ESE421	Special Topics in Pollution Control Engineering I
Elective	PCE407	Hydraulics	ESE416	Hydraulics
Elective	PCE408	Special Topics in Environmental Engineering II	ESE422	Special Topics in Environmental Engineering II
Elective	PCE409	Special Topics in Environmental Engineering III	ESE423	Special Topics in Environmental Engineering III

☐ Earth Science and Engineering [ESE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	ESE202	Global Environment	ESE203	Global Environment
Required	PCE201	Introduction to Environmental Engineering	ESE201	Introduction to Environmental Engineering
Required	ESE302	Analysis of Pollutants	ESE331	Analysis of Pollutants
Required	ESE490	Interdisciplinary Project		
IT course	DRE321	Numerical Modeling and Analysis	DME321	Numerical Modeling and Analysis
Elective	ESE201	Environmental Chemistry	ESE231	Environmental Chemistry
Elective	ESE203	Atmosphere and Ocean Sciences	ESE232	Atmosphere and Ocean Sciences
Elective	ESE204	Environmental Geology	ESE233	Environmental Geology
Elective	ESE205	Atmospheric Chemistry	ESE231	Atmospheric Chemistry
Elective	PCE202	Air Pollution	ESE205	Air Pollution
Elective	PCE203	Water Pollution	ESE204	Water Pollution
Elective	UDE210	Geographic Information System	UIE210	Geographic Information System
Elective	DRE201	Introduction to Natural Hazards	DME201	Introduction to Natural Hazards
Elective	NCS201	Organic Chemistry I	CHM211	Organic Chemistry I
Elective	NCS251	Physical Chemistry I	CHM231	Physical Chemistry I
Elective	ESE301	Environmental Impact Assessment	ESE336	Environmental Impact Assessment
Elective	ESE303	Environmental Ecology		
Elective	ESE304	Hydrology	ESE332	Hydrology
Elective	ESE305	Introduction to Remote Sensing	ESE333	Introduction to Remote Sensing
Elective	ESE306	Atmospheric Dynamics	ESE334	Atmospheric Dynamics
Elective	ESE307	Biogeochemistry	ESE335	Biogeochemistry
Elective	PCE302	Soil Pollution	ESE312	Soil Pollution
Elective	PCE303	Aquatic Chemistry Laboratory	ESE313	Aquatic Chemistry Laboratory
Elective	NCS301	Instrumental Analysis	CHM391	Instrumental Analysis
Elective	ESE404	Climate Dynamics	ESE431	Climate Dynamics
Elective	ESE405	Earth Environment Numerical Analysis	ESE432	Earth Environment Numerical Analysis
Elective	ESE407	Special Topics in Earth Science Engineering I	ESE441	Special Topics in Earth Science I
Elective	ESE408	Special Topics in Earth Science Engineering II	ESE442	Special Topics in Earth Science II
Elective	ESE409	Satellite Remote Sensing	ESE433	Satellite Remote Sensing
Elective	ESE410	Climate Change Engineering	ESE434	Climate Change Engineering
Elective	ESE411	Special Topics in Earth Science Engineering III	ESE443	Special Topics in Earth Science Engineering III
Elective	PCE402	Environmental Remediation	ESE412	Environmental Remediation

□ Affective and Human Factors Engineering [AHE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	AHE203	Human Physical Capacity	AHE203	HSE Required : Physical Ergonomics
	DHE402	Creative Design	DHE402	DHE Required : Creative Design 2
1TR : R 2TR : E	AHE311	Usability Engineering	AHE311	HSE Required : Usability Engineering
	AHE411	Safety Engineering	AHE411	HSE Required : Safety Engineering
Elective	AHE302	Affective Engineering	AHE402	HSE Elective : Affective Engineering
	AHE313	Color Image Engineering	AHE302	HSE Required : Perception
	DHE312	UI / UX Design	AHE311	HSE Required : Usability Engineering
	DHE315	High Touch Design	DHE312	HSE Elective : High Touch Design
	AHE400	Special Topics in AHE I	AHE410	HSE Elective : Special Topics in AHE I
	AHE401	Special Topics in AHE II	AHE420	HSE Elective : Special Topics in AHE II
	AHE402	Special Topics in AHE III	AHE430	HSE Elective : Special Topics in AHE III

□ Engineering and Systems Design [ESD] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	ESD201	Design IT	ESD204	HSE Required : Computational Tools for Engineers
	DHE311	3D CAD & Prototyping	IID303	HSE Elective : 3D CAD & Prototyping or Engineering Drawing and Analysis
	ESD301	Engineering Design Methods	ESD401	HSE Required : Engineering Design Methods
	AHE301	Experimental Design	AHE301	HSE Required : Experimental Design or Engineering Mechanics I or Basic Circuit Theory
	ESD401	Engineering Design Project	DHE401	DHE Required : Creative Design 1
	DHE402	Creative Design	DHE402	DHE Required : Creative Design 2
1TR : R 2TR : E	ESD211	System Control	ESD303	HSE Required : System Control
	ESD311	Manufacturing System Design & Simulation	ESD302	HSE Required : Manufacturing System Design & Simulation
Elective	ESD312	Design for X	ESD403	HSE Elective : Reliability Engineering
	ESD411	Introduction to Vehicle Design	ESD403	HSE Elective : Reliability Engineering
	DHE315	High Touch Design	DHE312	HSE Elective : High Touch Design
	AHE201	Introduction to Human Factors Engineering	AHE201	HSE Required : Introduction to Human Factors Engineering
	IID313	Design Research Methodology	DHE302	DHE Required : DHE Research Methods
	IID314	Interactive Technology	IID304	HSE Elective : Interactive Technology
	EE201	Basic Circuit Theory	ESD202	HSE Required : Basic Circuit Theory & Lab
	ESD480	Special Topics in ESD I	ESD410	HSE Elective : Special Topics in ESD I
	ESD481	Special Topics in ESD II	ESD420	HSE Elective : Special Topics in ESD II
	ESD482	Special Topics in ESD III	ESD430	HSE Elective : Special Topics in ESD III

Materials Science and Engineering [MSE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	MSE202	Introduction to Materials Science and Engineering	AMS202	Introduction to Materials Science and Engineering
			NME202	Introduction to Materials Science and Engineering
	MSE203	Physical Chemistry of Materials Ⅰ: Thermodynamics	AMS203	Thermodynamics of Materials
			NME203	Thermodynamics of Materials
	MSE230	Introduction to Crystallography	AMS230	Introduction to Crystallography
	MSE312	Phase Transformations in Materials	AMS312	Phase Transformations in Materials
	MSE350	Solid State Physics of Materials	AMS350	Solid State Physics of Materials I
	MSE490	Interdisciplinary Project	P/F	
1TR:R 2TR:E	MSE212	Mechanical Behavior of Materials	NME313	Mechanical Behavior of Materials
	MSE300	Materials Lab	AMS300	Materials Lab
Elective	MSE211	Physical Chemistry of Materials Ⅱ: Reaction Engineering	NME252	Physical Chemistry of Materials : Reaction Engineering
	MSE250	Modern Physics of Materials	NME250	Modern Physics of Materials
	MSE301	Organic Materials Lab	NME301	Nanomaterials Lab
	MSE302	Semiconducting Materials Lab	NME301	Nanomaterials Lab
	MSE303	Metallic Materials Lab	NME301	Nanomaterials Lab
	MSE311	Introduction to Metallic Materials	AMS311	Introduction to Metallic Materials
	MSE351	Thin Film Technology	AMS351	Thin Film Technology
	MSE353	Introduction to Nanomaterials	NME353	Introduction to Nanomaterials
	MSE354	Introduction to Semiconductor	NME354	Introduction to Semiconductor
	MSE370	Introduction to Polymer Materials	NME370	Introduction to Polymer Materials
	MSE371	Soft Materials Engineering	NME371	Introduction to Flexible Electronics
	MSE390	Introduction to Computational Materials Science	AMS390	Introduction to Computational Materials Science
	MSE401	Transmission Electron Microscopy	AMS401	Transmission Electron Microscopy
	MSE410	Dislocation Theory	AMS314	Defects in Crystals
	MSE313	Physical Metallurgy	NME315	Physical Metallurgy
	MSE430	Electrical Ceramics	NME430	Nano-Electroceramics
	MSE431	Magnetic Properties of Materials	AMS431	Magnetic Properties of Materials
	MSE452	Semiconducting Devices and Process	NME452	Nano Semiconducting Materials
	MSE454	Thin Film Mechanics	NME454	Nano-Materials Reliability
	MSE470	Polymer Physics	NME470	Polymer Physics
	MSE497	Special Topics in Materials Science Ⅰ	Remove	
	MSE498	Special Topics in Materials Science Ⅱ	Remove	
	MSE499	Special Topics in Materials Science Ⅲ	Remove	

☐ Energy Conversion and Storage [ECS] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	ECS211	Organic Chemistry I	ENE211	Organic Chemistry I
	ECS214	Analytical Chemistry	ENE213	Analytical Chemistry
	ECS221	Lab for Energy Materials	ENE223	Lab for Energy Materials
	ECS222	Inorganic Chemistry I	ENE311	Inorganic Chemistry I
	ECS241	Physical Chemistry I	ENE212	Physical Chemistry I
	ECS242	Physical Chemistry II	ENE222	Physical Chemistry II : Kinetics
	ECS313	Polymer Material Science	ENE321	Polymer Material Science
	ECS314	Electrochemistry	ENE312	Electrochemistry
	ECS321	Solid State Chemistry I	ENE313	Solid State Chemistry I
	ECS333	Instrumental Analysis	ENE322	Instrumental Analysis
	ECS341	Energy Conversion and Storage Lab	ENE314	Energy Conversion and Storage Lab
	ECS490	Interdisciplinary Project	Removed	
Elective	ECS236	Organic Chemistry II	ENE221	Organic Chemistry II
	ECS237	Polymer Concepts	ENE226	Polymer Concepts
	ECS316	Fundamentals of Energy Materials	ENE317	Fundamentals of Energy Materials
	ECS318	Electronic Devices	ENE316	Electronic Devices
	ECS319	Introduction to Solar Cells	ENE318	Introduction to Solar Cells
	ECS326	Physical Chemistry III	ENE319	Physical Chemistry III : Quantum Mechanics
	ECS336	Inorganic Chemistry II	ENE326	Inorganic Chemistry II
	ECS337	Solar Cells Lab	ENE323	Solar Cells Lab
	ECS339	Solid State Chemistry II	ENE327	Solid State Chemistry II
	ECS400	Special Topics in ECS I	ENE400	Special Topics in ECS I
	ECS401	Special Topics in ECS II	ENE401	Special Topics in ECS II
	ECS402	Special Topics in ECS III	ENE402	Special Topics in ECS III
	ECS422	Introduction to Nanoscience and Nanotechnology	ENE416	Introduction to Nanoscience and Nanotechnology
	ECS480	Scientific Expression with IT	ENE480	Scientific Expression with IT
	ACE431	Introduction to Catalysis	ACE431	Introduction to Catalysis
	CSE202	Advanced Programming	CSE241	Object Oriented Programming
	EE201	Basic Circuit Theory	EE201	Basic Circuit Theory
	DPH201	Electromagnetics I	EE231	Electromagnetics I
	DPH303	Quantum Mechanics I	PHY301	Quantum Physics I
	DPH305	Thermal and Statistical Physics	PHY303	Thermal and Statistical Physics
	DPH401	Solid State Physics	PHY315	Solid State Physics
	MSE202	Introduction to Materials Science and Engineering	AMS202	Introduction to Materials Science and Engineering
	MSE230	Introduction to Crystallography	AMS230	Introduction to Crystallography
	MSE250	Modern Physics of Materials	NME250	Modern Physics of Materials
	MSE302	Semiconducting Materials Lab	NME301	Nanomaterials Lab
	MSE350	Solid State Physics of Materials	AMS350	Solid State Physics of Materials
	MSE353	Introduction to Nanomaterials	NME251	Introduction to Nanomaterials
	MSE354	Introduction to Semiconductor	NME354	Introduction to Semiconductor
	MSE470	Polymer Physics	NME470	Polymer Physics
	TFP301	Numerical Analysis	MEN301	Numerical Analysis

□ Nuclear Science and Engineerign [NUE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	NUE213	Fundamentals of Nuclear Engineering	NSE213	Fundamentals of Nuclear Engineering
	NUE214	Introduction to Nuclear Fuel Cycle Engineering	NSE214	Introduction to Nuclear Fuel Cycle Engineering
	NUE221	Nuclear Radiation Engineering & Experiment	NSE221	Nuclear Radiation Engineering & Experiment
	NUE222	Nuclear Materials Engineering & Experiment	NSE222	Nuclear Materials Engineering & Experiment
	NUE231	Introduction to Nuclear Reactor Theory	NSE311	Introduction to Nuclear Reactor Theory
	NUE314	Nuclear Engineering Design and Lab I	NSE314	Nuclear Engineering Design and Lab I
	NUE324	Nuclear Engineering Design and Lab II	NSE324	Nuclear Engineering Design and Lab II
	NUE325	Nuclear System Engineering & Experiment	NSE325	Nuclear System Engineering & Experiment
	NUE342	Nuclear Reactor Lab	NSE342	Nuclear Reactor Lab
	NUE490	Interdisciplinary Project	Removed	
	NUE316	Fundamentals of Electromagnetics	NSE216	Fundamentals of Electromagnetics
	NUE326	Nuclear Reactor Numerical Analysis	NSE326	Nuclear Reactor Numerical Analysis
	NUE327	Introduction to Nuclear Fuel Engineering	NSE429	Introduction to Nuclear Fuel Engineering
	NUE400	Special Topics on Nuclear Engineering and Science I	NSE400	Special Topics on Nuclear Engineering and Science I
	NUE401	Special Topics on Nuclear Engineering and Science II	NSE401	Special Topics on Nuclear Engineering and Science II
	NUE402	Special Topics on Nuclear Engineering and Science III	NSE402	Special Topics on Nuclear Engineering and Science III
	NUE416	Introductory Quantum Physics	Removed	
	NUE426	Quantum Physics	Removed	
	NUE427	Fundamentals of Nuclear Fusion	NSE427	Fundamentals of Nuclear Fusion
	ECS241	Physical Chemistry I	ENE212	Physical Chemistry I
	ECS333	Instrumental Analysis	ENE322	Instrumental Analysis
	ECS422	Introduction to Nanoscience and Nanotechnology	ENE416	Introduction to Nanoscience and Nanotechnology
	ECS480	Scientific Expression with IT	ENE480	Scientific Expression with IT
	EE201	Basic Circuit Theory	EE201	Basic Circuit Theory

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Elective	EE211	Probability and Introduction to Random Processes	EE211	Probability and Introduction to Random Processes
	CSE232	Discrete Mathematics	CSE232	Discrete Mathematics
	CSE211	Introduction to Programming Languages	CSE341	Principles of Programming Languages
	DPH201	Electromagnetics I	EE231	Electromagnetics I
	DPH303	Quantum Mechanics I	PHY301	Quantum Physics I
	DPH305	Thermal and Statistical Physics	PHY303	Thermal and Statistical Physics
	DPH401	Solid State Physics	PHY315	Solid State Physics
	SDM230	Solid Mechanics I	CSE241	Object Oriented Programming
	SDM270	Dynamics	MEN270	Dynamics
	TFP210	Thermodynamics	MEN210	Thermodynamics
	TFP220	Fluid Mechanics	MEN220	Fluid Mechanics
	TFP211	Applied Thermodynamics	MEN211	Applied Thermodynamics
	TFP301	Numerical Analysis	MEN301	Numerical Analysis
	TFP310	Heat Transfer	MEN310	Heat Transfer
	TFP320	Applied Fluid Mechanics	MEN320	Applied Fluid Mechanics
	TFP457	Introduction to Electric-Electronic Engineering	MEN457	Introduction to Electric-Electronic Engineering
	MSE202	Introduction to Materials Science and Engineering	NME202	Introduction to Materials Science and Engineering
	MSE203	Physical Chemistry of Materials I : Thermodynamics	NME203	Physical Chemistry of Materials I : Thermodynamics

☐ Chemical Engineering [ACE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	NCS201	Organic Chemistry I	ACE201	Organic Chemistry I
			CHM211	Organic Chemistry I
	NCS251	Physical Chemistry I	CHM231	Physical Chemistry I
			ENE212	Physical Chemistry I
	ACE311	Chemical Reaction Engineering	ACE311	Chemical Reaction Engineering
	ACE232	Transport Phenomena I	ACE331	Transport Phenomena I
	ACE351	Introduction to Polymer Science and Engineering	ACE351	Introduction to Polymer Science and Engineering
	ACE490	Interdisciplinary Project		
1TR: R 2TR: E	ACE212	Introduction to Chemical Process	ACE212	Introduction to Chemical Process
	ACE231	Chemical Engineering Thermodynamics	ACE231	Chemical Engineering Thermodynamics
Elective	NCS211	Analytical Chemistry	CHM291	Analytical Chemistry I
	NCS231	Organic Chemistry II	CHM212	Organic Chemistry II
			ACE202	Organic Chemistry II
	NCS252	Physical Chemistry II	CHM232	Physical Chemistry II
	NCS253	Physical Chemistry III	CHM333	Physical Chemistry III
	NCS261	Organic/Physical Chemistry Laboratory I	CHM201	Organic Chemistry Laboratory I
	NCS301	Instrumental Analysis	CHM391, ACE391	Instrumental Analysis
	NCS311	Introduction to Nanoscience and Nanotechnology	CHM371	Introduction to Nanochemistry
	NCS321	Inorganic Chemistry I	CHM351	Inorganic Chemistry I
	NCS361	Organic/Physical Chemistry Laboratory II	ACE361	Organic/Physical Chemistry Laboratory
	ACE302	Advanced Chemical Engineering Laboratory	ACE302	Advanced Chemical Engineering Laboratory
	ACE322	Introduction to Electronics Processing	-	-
	ACE332	Transport Phenomena II	ACE332	Transport Phenomena II
	ACE352	Polymer Materials	ACE352	Polymer Materials
	ACE431	Introduction to Catalysis	ACE431	Introduction to Catalysis
	BEN301	Computational Methods for Biological and Chemical Engineering	ACE301	Computational Methods for Chemical Engineering
	BEN431	Materials for Biomedical Applications	-	-
	BMS211	Biochemistry I	BIO211	Biochemistry I
			CHM321	Biochemistry I
	ECS321	Solid State Chemistry I	ACE321, ENE313	Solid State Chemistry I
	ECS336	Inorganic Chemistry II	ENE326, CHM352	Inorganic Chemistry II
	TFP211	Applied Thermodynamics	MEN211	Applied Thermodynamics
	ACE401	Special Topics in Chemical Engineering I	ACE401	Special Topics in Chemical Engineering I
	ACE402	Special Topics in Chemical Engineering II	ACE402	Special Topics in Chemical Engineering II
	ACE403	Special Topics in Chemical Engineering III	ACE403	Special Topics in Chemical Engineering III

☐ Biomedical Sciences [BMS] (discontinued track)

[BMS] Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	BMS211	Biochemistry I	BIO211	Biochemistry I
	BMS261	Biochemistry Laboratory	BIO261	Biochemistry Laboratory
	BMS201	Molecular Biology	BIO201	Molecular Biology
	BMS301	Cell Biology	BIO301	Cell Biology
	BMS332	Anatomy and Physiology	BIO332	Anatomy and Physiology
	BMS490	Interdisciplinary Project		
1TR: R 2TR: E	BMS221	Biochemistry II	BIO221	Biochemistry II
	BMS302	Developmental Biology	BIO302	Developmental Biology
Elective	NCS201	Organic Chemistry I	CHM211	Organic Chemistry I
			ACE201	Organic Chemistry I
	ACE311	Chemical Reaction Engineering	ACE311	Chemical Reaction Engineering
	BEN231	Microbiology	BIO331	Microbiology
	BEN301	Computational Methods for Biological and Chemical Engineering	ACE301	Computational Methods for Chemical Engineering
			BME301	Computational Methods for Biosciences and Bioengineering
	BEN314	Instrumental Bioanalysis	BIO314	Instrumental Bioanalysis
	BEN316	Protein Engineering	BIO316	Protein Science
	BEN317	Metabolic Engineering	–	–
	BEN323	Biochemical Engineering	BME323	Biochemical Engineering
	BEN331	Biomedical Imaging	BME431	Biomedical Imaging
	BEN411	Physical Biology of the Cell	BME411	Physical Biology of the Cell
	BEN412	Microbial Physiology	BIO412	Microbial Physiology
	BEN413	Biomedical Instrumentation Laboratory	BME413	Biomedical Instrumentation Laboratory
	BEN431	Materials for Biomedical Applications	–	–
	BEN435	Tissue Engineering	BME435	Biomaterials and Tissue Engineering
	BMS202	Molecular Biology Laboratory	BIO202	Molecular Biology Laboratory
	BMS333	Genetics	BIO333	Genetics
	BMS361	Cell Biology & Genetics Laboratory	BIO361	Cell Biology & Genetics Laboratory
	BMS431	Bioinformatics	BIO431	Bioinformatics
	BMS432	Immunology	BIO432	Immunology
	BMS401	Special Topics in Biomedical Science I	BIO401	Special Topics in Biomedical Engineering I
	BMS402	Special Topics in Biomedical Science II	BIO402	Special Topics in Biomedical Engineering II
	BMS403	Special Topics in Biomedical Science III	BIO403	Special Topics in Biomedical Engineering III

Biological Engineering [BEN] (discontinued track)

[BEN] Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	BMS211	Biochemistry I	BIO211	Biochemistry I
	BMS261	Biochemistry Laboratory	BIO261	Biochemistry Laboratory
	ACE311	Chemical Reaction Engineering	ACE311	Chemical Reaction Engineering
	BEN311	Transport Phenomena in Biological Systems	BME311	Transport Phenomena in Biological Systems
	BEN321	Nano-Bioengineering	BME421	Nano-Bioengineering
	BEN490	Interdisciplinary Project		
1TR: R 2TR: E	BEN413	Biomedical Instrumentation Laboratory	BME413	Biomedical Instrumentation Laboratory
Elective	NCS211	Analytical Chemistry	CHM291	Analytical Chemistry I
	NCS201	Organic Chemistry I	CHM211	Organic Chemistry I
	NCS251	Physical Chemistry I	CHM231	Physical Chemistry I
	ACE322	Introduction to Electronics Processing	-	-
	ACE352	Polymer Materials	ACE352	Polymer Materials
	BEN231	Microbiology	BIO331	Microbiology
	BEN301	Computational Methods for Biological and Chemical Engineering	BME301	Computational Methods for Biosciences and Bioengineering
	BEN314	Instrumental Bioanalysis	BIO314	Instrumental Bioanalysis
	BEN316	Protein Engineering	BIO316	Protein Science
	BEN317	Metabolic Engineering	-	-
	BEN319	Optics and Imaging	BME319	Optics and Imaging
	BEN323	Biochemical Engineering	BME323	Biochemical Engineering
	BEN331	Biomedical Imaging	BME431	Biomedical Imaging
	BEN411	Physical Biology of the Cell	BME411	Physical Biology of the Cell
	BEN412	Microbial Physiology	BIO412	Microbial Physiology
	BEN431	Materials for Biomedical Applications	BME435	Biomaterials and Tissue Engineering
	BEN435	Tissue Engineering	BME435	Biomaterials and Tissue Engineering
	BMS201	Molecular Biology	BIO201	Molecular Biology
	BMS202	Molecular Biology Laboratory	BIO202	Molecular Biology Laboratory
	BMS221	Biochemistry II	BIO221	Biochemistry II
	BMS301	Cell Biology	BIO301	Cell Biology
	BMS302	Developmental Biology	BIO302	Developmental Biology
	BMS332	Anatomy and Physiology	BIO332	Anatomy and Physiology
	BMS361	Cell Biology & Genetics Laboratory	BIO361	Cell Biology & Genetics Laboratory
	MSE202	Introduction to Materials Science and Engineering	NME201	Introduction to Materials Science and Engineering
	EE201	Basic Circuit Theory	EE201	Basic Circuit Theory
	ECS314	Electrochemistry	ENE312	Electrochemistry
	SDM451	Introduction to MEMS	MEN451	Introduction to MEMS

[BEN] Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
	BEN401	Special Topics in Bioengineering Ⅰ	BME401	Special Topics in Biomedical Engineering Ⅰ
	BEN402	Special Topics in Bioengineering Ⅱ	BME402	Special Topics in Biomedical Engineering Ⅱ
	BEN403	Special Topics in Bioengineering Ⅲ	BME403	Special Topics in Biomedical Engineering Ⅲ

□ Device Physics [DPH] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
DIT	CSE201	Digital System Lab	CSE201	Digital System Lab
Required	DPH201	Electromagnetics Ⅰ	EE231	Electromagnetics Ⅰ
			PHY203	Electromagnetism Ⅰ
	DPH301	Introduction to electronic devices	EE331	Introduction to electronic devices
	DPH302	Microelectronics Lab	ECE577	Microelectronics Lab
	DPH303	Quantum mechanics Ⅰ	PHY301	Quantum Physics Ⅰ
	DPH490	Interdisciplinary Project		
	EE201	Basic Circuit Theory	EE201	Basic Circuit Theory
1TR:R 2TR:E	DPH202	Electromagnetics Ⅱ	PHY204	Electromagnetism Ⅱ
	DPH304	Quantum mechanics Ⅱ	PHY302	Quantum Physics Ⅱ
Elective	DPH305	Thermal and statistical physics	PHY303	Thermal and statistical physics
	DPH401	Solid state physics	PHY315	Solid state physics
	DPH403	Modern VLSI Devices	EE431	Semiconductor VLSI Devices Engineering
	DPH405	Optoelectronics	EE432	Optoelectronics
	DPH480	Special Topics in DPH Ⅰ	PHY471	Special Topics in Physics Ⅰ
	DPH481	Special Topics in DPH Ⅱ	PHY472	Special Topics in Physics Ⅱ
	DPH482	Special Topics in DPH Ⅲ	PHY473	Special Topics in Physics Ⅲ
	EE301	Microelectronics Ⅰ	EE301	Microelectronics Ⅰ
	EE302	Microelectronics Ⅱ	EE302	Microelectronics Ⅱ
	MSE250	Modern Physics of Materials	MSE250	Modern Physics of Materials
			PHY213	Modern Physics

* "DPH201" can be recognized "EE231" or "PHY203".
* "MSE250" can be recognized "MSE250" or "PHY213“.

☐ Nanochemistry (NCS) (discontinued track)

[NCS] Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	NCS201	Organic Chemistry I	CHM211	Organic Chemistry I
			ACE201	Organic Chemistry I
	NCS211	Analytical Chemistry	CHM291	Analytical Chemistry I
	NCS231	Organic Chemistry II	CHM212	Organic Chemistry II
			ACE202	Organic Chemistry II
	NCS251	Physical Chemistry I	CHM231	Physical Chemistry I
			ENE212	Physical Chemistry I
	NCS321	Inorganic Chemistry I	CHM351	Inorganic Chemistry I
	NCS490	Interdisciplinary Project	CHM490	Interdisciplinary Project
1TR: R 2TR: E	NCS252	Physical Chemistry II	CHM232	Physical Chemistry II
	NCS311	Introduction to Nanoscience and Nanotechnology	CHM371	Introduction to Nanochemistry
Elective	NCS253	Physical Chemistry III	CHM333	Physical Chemistry III
	NCS261	Organic/Physical Chemistry Laboratory I	CHM201	Organic Chemistry Laboratory I
	NCS301	Instrumental Analysis	CHM391, ACE391	Instrumental Analysis
	NCS361	Organic/Physical Chemistry Laboratory II	ACE361	Organic/Physical Chemistry Laboratory
			CHM202	Physical/Analytical Chemistry Laboratory
	ACE212	Introduction to Chemical Process	ACE212	Introduction to Chemical Process
	ACE322	Introduction to Electronics Processing	–	–
	ACE351	Introduction to Polymer Science and Engineering	ACE351	Introduction to Polymer Science and Engineering
	ACE352	Polymer Materials	ACE352	Polymer Materials
	ACE431	Introduction to Catalysis	ACE431	Introduction to Catalysis
	BEN301	Computational Methods for Biological and Chemical Engineering	ACE301	Computational Methods for Chemical Engineering
			BME301	Computational Methods for Biosciences and Bioengineering

[NCS] Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
	BEN431	Materials for Biomedical Applications	-	-
	BMS211	Biochemistry I	CHM321	Biochemistry I
			BIO211	Biochemistry I
	MSE202	Introduction to Materials Science and Engineering	AMS202, NME202	Introduction to Materials Science and Engineering
	MSE211	Physical Chemistry of Materials II: Reaction Engineering	NME252	Physical Chemistry of Materials II: Reaction Engineering
	MSE351	Thin Film Technology	AMS351	Thin Film Technology
	MSE371	Soft Materials Engineering	NME371	Introduction to Flexible Electronics
	MSE452	Semiconducting Devices and Process	NME452	Nano-Semiconducting Devices
	MSE454	Thin film Mechanics	NME454	Nano-Materials Reliability
	MSE470	Polymer Physics	NME470	Polymer Physics
	EE201	Basic Circuit Theory	EE201	Basic Circuit Theory
	ECS314	Electrochemistry	ENE312	Electrochemistry
	ECS321	Solid State chemistry I	ACE321	Solid State chemistry I
			ENE313	Solid State chemistry I
	ECS336	Inorganic Chemistry II	ENE326	Inorganic Chemistry II
	NCS401	Special Topics in Nanochemistry I	CHM401	Special Topics in Chemistry I
	NCS402	Special Topics in Nanochemistry II	CHM402	Special Topics in Chemistry II
	NCS403	Special Topics in Nanochemistry III	CHM403	Special Topics in Chemistry II

※ NCS students may take CHE courses which are equivalent to NCS elective courses.

☐ MGT Fundamental (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Fundamental	GMT101	Leadership and Teamwork	MGT101	Leadership and Teamwork
	ISM201	Dynamics of IT	MGT201	Dynamics of IT

☐ General Management [GM] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	GMT202	Organizational Behavior	MGT202	Organizational Behavior
	GMT204	Marketing Management	MGT204	Marketing Management
	GMT205	Financial Accounting	MGT205	Financial Accounting
	GMT206	Managerial Accounting	MGT206	Managerial Accounting
	GMT207	Financial Management	MGT207	Financial Management
	GMT208	Strategic Management	MGT308	Strategic Management
	GMT209	Operations Management	MGT209	Operations Management
	GMT210	Data Analysis &Decision Making	MGT210	Data Analysis &Decision Making
	GMT211	Microeconomics	MGT211	Microeconomics
	GMT490	Interdisciplinary Project		
Elective	GMT203	International Business	MGT203	International Business
	GMT321	Macroeconomics	MGT312	Macroeconomics
	GMT322	Econometrics	MGT315	Econometrics
	GMT323	Game Theory	MGT413	Game Theory
	GMT341	Business Ethics	MGT306	Business Ethics
	GMT351	Legal Environment of Business	MGT307	Legal Environment of Business
	GMT491	Independent Study	MGT491	Independent Study
	GMT492	Capstone Projects	MGT492	Capstone Projects I
	GMT410	Special Topics in GM I	MGT410	Special Topics in MGT I
	GMT411	Special Topics in GM II	MGT411	Special Topics in MGT II
	GMT412	Special Topics in GM III	Remove	

☐ Technology Management/Information System/Entrepreneurship [TIE] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	GMT202	Organizational Behavior	MGT202	Organizational Behavior
	GMT205	Financial Accounting	MGT205	Financial Accounting
	GMT207	Financial Management	MGT207	Financial Management
	GMT208	Strategic Management	MGT308	Strategic Management
	GMT209	Operations Management	MGT209	Operations Management
	GMT210	Data Analysis &Decision Making	MGT210	Data Analysis &Decision Making
	TIE490	Interdisciplinary Project		
Elective	GMT323	Game Theory	MGT413	Game Theory
	GMT341	Business Ethics	MGT306	Business Ethics
	GMT351	Legal Environment of Business	MGT307	Legal Environment of Business
	GMT491	Independent Study	MGT491	Independent Study
	GMT492	Capstone Projects	MGT492	Capstone Projects I
	TIE301	Technology Management	MGT361	Technology Management
	TIE302	Process & Quality Management	MGT362	Process & Quality Management
	TIE303	Operations Research	MGT363	Operations Research
	TIE321	Database and Data Mining	MGT364	Database
	TIE322	Internet Business and Marketing	MGT372	Internet Business and Marketing
	TIE323	Strategic Management of IT	MGT373	Strategic Management of IT
	TIE324	Mobile Business	MGT374	Mobile Business
	TIE325	System Analysis and Design	MGT465	System Analysis and Design
	TIE410	Special Topics in TIE I	MGT410	Special Topics in MGT I
	TIE430	Special Topics in TIE II	MGT411	Special Topics in MGT II
	TIE441	Managing innovation and Change	MGT471	Managing innovation and Change
	TIE443	Entrepreneurship and Venture Management	MGT434	Experimental Design with Applications in Marketing
	TIE450	Special Topics in TIE III	Remove	

☐ Marketing/ International Business [MIB] (discontinued track)

Course for 2013 Curriculum			Correspondence/Substitution to 2014 Curriculum	
Course is	Course No.	Course Title	Course No.	Course Title
Required	GMT204	Marketing Management	MGT204	Marketing Management
	GMT207	Financial Management	MGT207	Financial Management
	GMT208	Strategic Management	MGT308	Strategic Management
	GMT210	Data Analysis &Decision Making	MGT210	Data Analysis &Decision Making
	GMT211	Microeconomics	MGT211	Microeconomics
	MIB301	Consumer Behavior	MGT330	Consumer Behavior
	MIB490	Interdisciplinary Project		
Elective	GMT203	International Business	MGT203	International Business
	GMT321	Macroeconomics	MGT312	Macroeconomics
	GMT322	Econometrics	MGT315	Econometrics
	GMT341	Business Ethics	MGT306	Business Ethics
	GMT351	Legal Environment of Business	MGT307	Legal Environment of Business
	GMT491	Independent Study	MGT491	Independent Study
	GMT492	Capstone Projects	MGT492	Capstone Projects I
	TIE321	Database and Data Mining	MGT364	Database
	TIE322	Internet Business and Marketing	MGT372	Internet Business and Marketing
	MIB321	International Marketing	MGT331	International Marketing
	MIB322	International Finance	MGT318	International Finance
	MIB323	Brand Management	MGT332	Brand Management
	MIB402	Marketing Research	MGT432	Marketing Research
	MIB403	Advertising Management	MGT433	Advertising Management
	MIB404	Experimental Design with Applications in Marketing	MGT434	Experimental Design with Applications in Marketing
	MIB409	Case Studies in Marketing	MGT435	Case Studies in Marketing
	MIB410	Special Topics in MIB I	MGT410	Special Topics in MGT I
	MIB411	Special Topics in MIB II	MGT411	Special Topics in MGT II
	MIB430	Special Topics in MIB III	Remove	
	MIB421	Global Business Strategy	MGT441	Global Business Strategy
	MIB429	Case Studies in International Business	MGT442	Case Studies in International Business

2014 Course Catalog
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Department of Electrical Engineering

□ Electrical Engineering [EE]

Electrical Engineering (EE) program is one of the two graduate programs offered by the school of ECE at UNIST. Over 16 faculty members are committed to the EE program while actively contributing in various research groups – Image Processing and Computer Vision Research Group, Next Generation Communication & Smart Control Research Group, Semiconductor Device & Circuit Design Research Group, EM & Wireless Power Transfer Research Group. EE program is firmly committed to sustaining excellence in traditional areas of strength while venturing into areas of opportunity. Research and education in EE program includes the area of Communication, Control, Signal Processing; Analog, Digital, RF Circuit Design; Power Electronics and Systems; Electronic Devices and Materials; Plasma and Vacuum Electronics; Photonics.

• Communication, Control, & Signal Processing

The Communication, Control, and Signal Processing Track focuses on research and development of IT convergence systems that are capable of enriching the future human society with pleasant, secured, convenient, and socially connected living environments. The broad range of IT technologies covered by the track is cohesively merged together to reap the new benefits in the aforementioned ubiquitous information society driven by the digital convergence. The research areas in Communication, Control, and Signal Processing include cutting-edge future IT technologies and convergence systems such as wireless communications, channel coding for communication systems, wireless and mobile networking, human-friendly intelligent robotic systems, image and video processing, computer vision, 3D visual processing, machine learning, medical image processing, and future smart home systems.

• Analog, Digital, RF & Power Circuit Design

Analog, digital, RF & Power circuit design program focuses on a vital area of electrical engineering represented by the core technology needed in implementing many consumer electronics, automotive IT, communication systems and handheld devices. Research in analog and RF circuit design circuits includes high-speed analog-digital converters, RF and wireless communication ICs, sensor network devices, RFID, antenna design, automotive IT and e-health sensors. Research in VLSI digital circuits includes low-power and high-performance microprocessor and mixed signal circuits including CAD (computer-aided design), physical design, and design for testing and manufacturability, next generation semiconductor devices, packaging, and power/signal integrity. Research in power circuit design based on power electronics includes various power conversion circuits and systems such as dc-dc & ac-ac converters, dc-ac inverters, ac-dc PFCs, power conditioners, and their controllers for the applications of power interface technology such as smart grid, EV, renewable energy, and etc.

• Electronic Devices & Materials

The main research interests of electronic devices & materials major are basically in developing next-generation electronic devices that overcome the limitations of the conventional Si-based CMOS technology, and also exploring the material systems that can take fundamental roles of realizing those new electronic devices. The current research for electronic devices focus on nanoscale non-planar CMOS devices, multifunctional quantum devices, and new type of nonvolatile memory devices overwhelming the current flash memory devices. Regarding the material systems, we mainly focus on oxide thin films and wide bandgap semiconductors such as SiC and GaN that are particularly useful for noble electronic and optoelectronic devices. Another important research topic is for developing high-performance and portable THz detectors, which is a part of the cooperative research effort in Applied Physics program aiming at developing THz sensing system for security, safety, and medical applications.

• Plasma & Vacuum Electronics

The Plasma & Vacuum Electronics track focuses on basic plasma physics, beam-wave interaction, high power microwave/THz source development and its applications. Plasma physics is a major physics branch which has been researched for many decades, and there are being developed many devices/applications based on plasma physics.

We are interested in the idea of laser wakefield electron accelerator which is based on strong beam-wave interaction. Also, high power THz source development based on vacuum electronics is our main interest. We are currently working on developing a pulsed high power THz source. Using the high power THz source, we also research on its applications such as detection of radioactive material, and medical applications.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 29 credits	at least 24 credits	at least 5 credits
Doctoral Program	at least 33 credits	at least 18 credits	at least 15 credits
Combined Master's-Doctoral Program	at least 55 credits	at least 36 credits	at least 19 credits

□ Curriculum ▶ Electrical Engineering

Course is	Classification	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	Lecture	ECE530	Image Processing	영상처리	3-3-0	EE211, EE311	
		ECE531	Intelligent Systems	지능형시스템	3-3-0	EE211, EE311	
		ECE532	Linear System Theory	선형시스템이론	3-3-0	EE211, EE311, EE313	
		ECE533	Advanced Linear Algebra	고급선형대수학	3-3-0	EE211, EE311	
		ECE534	Modern Digital Communication Theory	디지털 통신 이론	3-3-0	EE412	
		ECE535	Robotics	로봇공학	3-3-0	EE211, EE311, EE313	
		ECE536	3D Visual Processing	3차원 영상처리	3-3-0	EE211, EE311	O
		ECE537	Audio Engineering	오디오 공학	3-3-0	EE411	
		ECE538	Data Communication Networks	데이터 통신망	3-3-0	EE211	O
		ECE539	Advanced Control Techniques	최신제어기법	3-3-0	EE313	
		ECE540	Stochastic Optimization	스토캐스틱 최적화	3-3-0	EE211	
		ECE541	Modern Probability Theory and Stochastic Processes	확률신호론	3-3-0	EE211, EE311	
		ECE542	Introduction to Medical Image Processing	의료영상처리의 기초	3-3-0	EE311	O
		ECE543	Computer Vision	컴퓨터 비전	3-3-0	EE211, EE311	O
		ECE550	Electric Machines and Drives	전기기기 및 제어	3-3-0	EE231	
		ECE551	Analog Filters	아날로그 필터	3-3-0	EE301	
		ECE552	Operational Amplifier Design	연산증폭기 설계	3-3-0	EE301	
		ECE553	Digital Integrated Circuits	디지탈 집적회로	3-3-0	EE301	O
		ECE554	Electronic Packaging Design	전자패키징설계	3-3-0	EE231	
		ECE555	Advanced Power Electronics	고급 전력전자 공학	3-3-0	EE231, EE301, EE404	
		ECE556	Antenna Engineering	안테나 공학	3-3-0	PHY204	
		ECE557	Data Converter Circuits	데이터 변환기 회로	3-3-0	EE301	
		ECE558	Advanced Analog IC Design	고급 아날로그 IC 디자인	3-3-0	EE301, EE302	
		ECE559	Wireless IC Design	무선 IC 디자인	3-3-0	EE301, EE302	
		ECE571	Advanced Electromagnetics	고급전자기학	3-3-0	EE231, PHY204	
		ECE572	Numerical methods in Electromagnetics	전자기장수치해석	3-3-0	EE231, PHY204	O
		ECE575	Modern RF Engineering	현대초고주파공학	3-3-0	EE231, PHY204	O
		ECE576	Advanced Photonics	고급 광자학	3-3-0		
		ECE577	Microelectronics Lab	전자소자실험	3-1-4	EE331	
		ECE578	Advanced Semiconductor Device Engineering	고급 반도체소자 공학	3-3-0		

Course is	Classification	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	Lecture	ECE630	Special Topics in Communication, Control, and Signal Processing Ⅰ	통신,제어 및 신호처리 특수토픽 Ⅰ	3-3-0		
		ECE631	Special Topics in Communication, Control, and Signal Processing Ⅱ	통신,제어 및 신호처리 특수토픽 Ⅱ	3-3-0		
		ECE632	Special Topics in Communication, Control, and Signal Processing Ⅲ	통신,제어 및 신호처리 특수토픽 Ⅲ	3-3-0		
		ECE633	Special Topics in Communication, Control, and Signal Processing Ⅳ	통신,제어 및 신호처리 특수토픽 Ⅳ	3-3-0		
		ECE634	Special Topics in Communication, Control, and Signal ProcessingⅤ	통신,제어 및 신호처리 특수토픽 Ⅴ	3-3-0		
		ECE635	Special Topics in Electronic Design and Applications Ⅰ	전자회로 설계및 응용 특수토픽 Ⅰ	3-3-0		
		ECE636	Special Topics in Electronic Design and Applications Ⅱ	전자회로 설계및 응용 특수토픽 Ⅱ	3-3-0		
		ECE637	Special Topics in Electronic Design and Applications Ⅲ	전자회로 설계및 응용 특수토픽 Ⅲ	3-3-0		
		ECE638	Special Topics in Electronic Design and Applications Ⅳ	전자회로 설계및 응용 특수토픽 Ⅳ	3-3-0		
		ECE639	Special Topics in Electronic Design and ApplicationsⅤ	전자회로 설계및 응용 특수토픽 Ⅴ	3-3-0		
		ECE731	Information Theory	정보이론	3-3-0	EE211, EE311, EE312, ECE541	
		ECE732	Advance Digital Signal Processing	고급디지털 신호처리	3-3-0	EE211, EE311, EE411, ECE541	
		ECE733	Optimal Control Theory	적응제어이론	3-3-0	EE211, EE311, ECE541	
		ECE734	Estimation &Decision Theory	추론 및 의사결정 이론	3-3-0	EE211, EE311, EE411, ECE541	
		ECE735	Pattern Recognition	패턴인식	3-3-0	EE211, EE311, ECE541	O
		ECE736	Channel Coding Theory	채널코딩이론	3-3-0	EE211, EE311, EE312, ECE541	
		ECE737	Data Compression	데이터 압축	3-3-0	EE211, EE311, ECE541	
		ECE738	Advanced Wireless Communication Theory	고급 무선 통신 이론	3-3-0	EE412, ECE534	
		ECE752	Advanced Integrated System Design	아날로그 시스템 디자인	3—3-0	EE301, EE302	
		ECE754	Low Noise Electronic System Design	저잡음 전자시스템 디자인	3-3-0	EE301, EE302	
		ECE755	Frequency Synthesizers	주파수 발생기 이론	3-3-0	EE301, EE302	
		ECE756	Electronic Oscillators	전자 발진기 이론	3-3-0	EE301, EE302	
		ECE772	Nanoscale Electronic Devices	나노전자소자	3-3-0	PHY315	O
		ECE773	Compound Semiconductor Devices	화합물 반도체 소자	3-3-0	PHY315	O
		ECE774	Plasma in Device Manufacturing	플라즈마공정	3-3-0	EE231, PHY204	O

Course is	Classification	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	Lecture	ECE775	Practical RF Engineering	실용 RF 공학	3-3-0		O
		ECE778	Electronic Carrier Transport Physics	전하 수송 물리	3-3-0		O
		ECE782	Nanophotonics	나노광자학	3-3-0		O
		ECE830	Advanced Topics in Communication, Control, and Signal Processing Ⅰ	통신,제어 및 신호처리 고급토픽 Ⅰ	3-3-0		
		ECE831	Advanced Topics in Communication, Control, and Signal Processing Ⅱ	통신,제어 및 신호처리 고급토픽 Ⅱ	3-3-0		
		ECE832	Advanced Topics in Communication, Control, and Signal Processing Ⅲ	통신,제어 및 신호처리 고급토픽 Ⅲ	3-3-0		
		ECE833	Advanced Topics in Communication, Control, and Signal Processing Ⅳ	통신,제어 및 신호처리 고급토픽 Ⅳ	3-3-0		
		ECE834	Advanced Topics in Communication, Control, and Signal Processing Ⅴ	통신,제어 및 신호처리 고급토픽Ⅴ	3-3-0		
		ECE835	Advanced Topics in Electronic Design and Applications Ⅰ	전자회로 설계및 응용 고급토픽 Ⅰ	3-3-0		
		ECE836	Advanced Topics in Electronic Design and Applications Ⅱ	전자회로 설계및 응용 고급토픽 Ⅱ	3-3-0		
		ECE837	Advanced Topics in Electronic Design and Applications Ⅲ	전자회로 설계및 응용 고급토픽 Ⅲ	3-3-0		
		ECE838	Advanced Topics in Electronic Design and Applications Ⅳ	전자회로 설계및 응용 고급토픽 Ⅳ	3-3-0		
		ECE839	Advanced Topics in Electronic Design and Applications Ⅴ	전자회로 설계및 응용 고급토픽 Ⅴ	3-3-0		
		PHY503	Electrodynamics Ⅰ	전기역학 Ⅰ	3-3-0		
		PHY505	Quantum Mechanics Ⅰ	양자역학 Ⅰ	3-3-0		
		PHY561	Plasma Physics	플라즈마 물리	3-3-0	EE231, PHY204	
		PHY723	Interface Physics of Electronic Devices	전자소자 계면물리	3-3-0	EE331	O
		PHY761	Physics of Vacuum Electron Devices	진공 전자소자 물리	3-3-0		O
		PHY763	Laser-Plasma Physics	레이저-플라즈마 물리	3-3-0		
		PHY765	Nuclear Fusion Engineering	핵융합 공학	3-3-0		O
		ECS571	Organic Electronics	유기일렉트로닉스	3-3-0		
Required	Research	ECE590	ECE Graduate Seminar	ECE 대학원 세미나	1-1-0		
		ECE690	Master's Research	석사논문연구	가변학점		
		ECE890	Doctoral Research	박사논문연구	가변학점		

□ Description

ECE530 Image Processing [영상처리]

This course introduces mathematical representations of continuous and digital images, basic coding schemes and formats, picture enhancement, models of image degradation and restoration, segmentation, and pattern recognition.

ECE531 Intelligent Systems [지능형시스템]

Intelligent Systems are studied with particular attentions to CI(Computational Intelligence)-based design techniques and their applications in uncertain/ambiguous environments. Topics includes fuzzy logic, artificial neural networks, evolutionary computation, support vector machine, swarm intelligence, immune systems with their real-life applications for automation system control and data/information processing including gesture and facial expression recognition.

ECE532 Linear System Theory [선형시스템이론]

This course provides basic unified system approaches for various engineering problems; equilibrium points and linearization, natural and forced response of state equations, system equivalence and Jordan form, BIBO stability, controllability and duality, control-theoretic concepts.

ECE533 Advanced Linear Algebra [고급선형대수학]

This course extends the undergraduate linear algebra and focus on vector spaces, dual vector spaces, eigenvalues and eigen vectors, Positive definiteness, Jordan form, linear transformations (e.g., orthogonal and unitary transformations), matrix decompositions (e.g., QR and singular value decompositions), least square approximation and linear programming.

ECE534 Modern Digital Communication Theory [디지털 통신 이론]

This course covers digital transmission of information over the channels using modern communication technologies. The topics include source coding, channel coding, digital modulation, decision theory, fundamental limits in coding and modulation, capacity and throughput analysis, and wireless channel model.

ECE535 Robotics [로봇공학]

This course introduces advanced topics in robot control methods such as servo mechanism design, man machine interface, teleoperation, force control, and stereo vision.

ECE536 3D Visual Processing [3차원 영상처리]

This course is offered to graduate students and introduces the researches in 3D Visual Processing. Topics include 3D data acquisition, 3D modeling, 3D data compression and transmission, 3D image processing, 3D rendering and visualization, and 3D display.

ECE537 Audio Engineering [오디오 공학]

This course studies concepts of acoustics and electroacoustic modeling for the analysis and design of microphones, loudspeakers, and crossover networks. Methods of analysis and design of audio power amplifiers are also covered.

ECE538 Data Communication Networks [데이터 통신망]

This course covers general connection methods of data networks and data communication architectures. The topics are: data link control (e.g., error correction, framing), message delay analysis (e.g., Markov processes, queuing), network delay analysis (e.g., Kleinrock independence, throughput analysis), and multiple access networks (e.g., ALOHA, carrier sensing).

ECE539 Advanced Control Techniques [최신제어기법]

Based on mathematical foundations, this course concerns advanced control methods such as adaptive control, robust control, predictive control, fuzzy control, etc.

ECE540 Stochastic Optimization [스토캐스틱 최적화]

This course is an introductory course for optimization of stochastic systems via mathematical modeling. The topics may include linear programming (e.g., simplex method, interior point method), convex optimization, dynamic programming (e.g., shortest path algorithm, infinite horizon problems, average cost optimization), and Markov decision process.

ECE541 Modern Probability Theory and Stochastic Processes [확률신호론]

This course covers probability theories such as probability measure, random variable, distribution, expectation, Markov chains, renewal theory and queuing theory, and stochastic processes such as Poisson process, random walks and Brown motion.

ECE542 Introduction to Medical Image Processing [의료 영상 처리의 기초]

Principles of modern medical imaging systems. For each modality the basic physics is described, leading to a mathematical systems model of the imager. Then, image reconstruction algorithm for each system will be derived. Modalities covered include radiography, x-ray computed tomography (CT), MRI, and ultra-sound.

ECE543 Computer Vision [컴퓨터 비전]

This course aims at learning how to extract valuable information from visual scenes using computers. Topics may include the basic theories for capturing images by cameras, human visual perception, filtering, edge detection, segmentation, stereo, motion analysis, feature extraction, and object recognition.

ECE550 Electric Machines and Drives [전기기기 및 제어]

Electric machine is an essential component in modern electric power applications such as electric vehicles, renewable energy generation, robotics, and industrial electronics. This course introduces the basic background of electric machines and drives, including the electromechanical energy conversion, steady-state and dynamic operations, control of AC and DC machines. As advanced topics, electromagnetic analysis and design of electric machines are also covered.

ECE551 Analog Filters [아날로그 필터]

This course is an introduction to the theory, design techniques, and applications of analog passive, active, and switched-capacitor filters.

ECE552 Operational Amplifier Design [연산증폭기 설계]

This course studies analysis and design techniques for the utilization of integrated circuit operational amplifiers for applications in electronic systems.

ECE553 Digital Integrated Circuits [디지털 집적회로]

This course studies analysis and design of MOS digital integrated circuit families necessary for Very Large Scale Integrated (VLSI) circuits and their applications in modern electronic systems. This course introduces full-custom (or semi-custom) integrated circuit design with help of several EDA tools (e.g., schematic and layout design, parasitic extraction, and DRC/LVS, etc). This course is highly project-oriented.

ECE554 Electronic Packaging Design [전자패키징설계]

The electronic packaging in real-world applications is compromised by artifacts of the analog and digital circuit design, IC package, and printed circuit boards. This course gives engineers the necessary skills in the circuit and electromagnetic designs to ensure signal quality between a driver and a receiver and electromagnetic compatibility.

ECE555 Advanced Power Electronics [고급 전력전자 공학]

The objective of this course is to study and discuss the recent technology of power electronics. Main topics will cover topology of new dc-dc converter, resonant converters, bidirectional converters, and PFCs. In addition, new control scheme for power electronics and hot applications such as smart gird, renewable energy, EV, and DC distribution/transmission will be treated.

ECE556 Antenna Engineering [안테나 공학]

This course is designed for understanding the fundamental theory of antennas used in various wireless applications. The course covers electromagnetic radiation theory, small antennas, array antennas, resonant antennas, broadband antennas, aperture antennas, and antenna synthesis theory. Practical aspects for antenna designs are also considered.

ECE557 Data Converter Circuits [데이터 변환기 회로]

Data converters are essential circuits to provide data conversions between analog signals and digital signals. Various ADC(Analog-to-Digital Converter) and DAC(Digital-to-Analog Converter) circuits and their recent technology trends are covered.

ECE558 Advanced Analog IC Design [고급 아날로그 IC디자인]

A progression from the Analog Integrated Circuits course, this course covers advanced and state-of-the-art design of analog circuits using CMOS and bipolar technology with emphasis on practical implementation and examples.

ECE559 Wireless IC Design 무선IC 디자인

Wireless system specifications are translated to architectures and building blocks compatible with silicon technology. The course focuses on the analysis and design of these blocks.

ECE571 Advanced Electromagnetics 고급전자기학

In this course we provide the student with the basic knowledge of electrodynamics, which are necessary to understand the advanced electrodynamics. The electrostatics, magnetostatics, boundary value problems, Maxwell equations, and wave propagations are covered.

ECE572 Numerical methods in Electromagnetics [전자기장수치해석]

This course introduces popular numerical techniques for simulating electromagnetic fields: the finite difference method, the finite element method and the method of moments. To assess the accuracy of numerical methods, von Neumann stability analysis, convergence analysis and dispersion analysis are used. As applications, we develop numerical codes for simulating scattering and antenna design.

ECE575 Modern RF Engineering [현대초고주파공학]

This course covers from the fundamentals of RF/microwave engineering to applications of RF/microwave devices based on in-depth knowledge of microwave components. The emerging millimeter, submillieter, and THz technology will be also introduced. Basic principles of RF oscillators, amplifiers, and passive components, and circuits will be introduced. Modern usage of RF/microwave/millimeter-wave components will be broadly covered.

ECE576 Advanced Photonics [고급 광자학]

This course intends to provide knowledge for a research in the field of photonics. It covers a few fundamental and advanced topics related to photonics, especially integrated waveguide based photonics. The topics include: electromagnetic waves in anisotropic media, Gaussian beam propagation, resonance, coupled-mode theory, nonlinear optical effect, and optical modulation.

ECE577 Microelectronics Lab [전자소자실험]

This course supplies students hands-on experiences on semiconductor device fabrication processes (oxidation, chemical cleaning/etching, lithography, diffusion, metalization) by actually making planar diodes and transistors on a silicon wafer in cleanroom environment. Students also learn about the methodologies of characterizing the fabricated devices.

ECE578 Advanced Semiconductor Device Engineering [고급 반도체소자 공학]

The main purpose of this course is to teach the basic knowledges of semiconductor governing equations such as Poisson's equation and continuity equations, and carrier transport equations on the numerical TCAD (technology computer-aided design) platform. In addition the course teaches discretization methods and how to solve nonlinear algebraic equations.

ECE630~ECE634 Special Topics in Communication, Control, and Signal Processing Ⅰ~Ⅴ [통신,제어 및 신호처리 특수토픽 Ⅰ~Ⅴ]

This course introduces new research topics in the field of Communication, Control, and Signal Processing I~V.

ECE635~ECE639 Special Topics in Electronic Design and Applications Ⅰ~Ⅴ[전자회로 설계및 응용 특수토픽 Ⅰ~Ⅴ]

This course introduces new research topics in the field of Electronic Design and Applications I~V.

ECE731 Information Theory [정보이론]

This course introduces information theory which is a base for efficient data storage, compression, and transmission in communications. The topics include entropy, channel capacity, source coding theorems, channel coding theorems, and rate-distortion theory.

ECE732 Advance Digital Signal Processing [고급디지털 신호처리]

This course introduces advanced signal processing methods. Topics include statistical and deterministic least square filters design, adaptive filtering, applications in beam-forming and spectral estimation.

ECE733 Optimal Control Theory [적응제어이론]

This course introduces optimal analysis and synthesis by the major procedures of classical calculus of variations and general theory of performance indices. Topics includes dynamic programming, mathematical programming, and variable-gradient techniques, parameter-perturbation, minimax, learning-system methods, and optimal control-system estimation.

ECE734 Estimation & Decision Theory [추론 및 의사결정 이론]

This course introduces estimation and decision theory applied to random processes and signals in noise: Bayesian, maximum likelihood, and least squares estimation; the Kalman filter; maximum likelihood and maximum a posteriori detection, and detection systems with learning features.

ECE735 Pattern Recognition [패턴인식]

This course introduces pattern recognition systems and their components. Topics include decision theories and classification, discriminant functions, supervised and unsupervised training, clustering, feature extraction and dimensional reduction, sequential and hierarchical classification, applications of training, feature extraction, and decision rules to engineering problems.

ECE736 Channel Coding Theory [채널코딩이론]

This course introduces basic error-correcting codes by which channel errors in communications can be detected or corrected. The topics include introductory coding theory, basic algebra for linear codes, and encoding/decoding of cyclic codes, BCH and Reed-Solomon codes, convolutional codes, and Turbo codes.

ECE737 Data Compression [데이터 압축]

This course introduces various theories and tools to efficiently store and transmit source data. Topics cover quantization theory, rate-distortion theory, lossless and lossy compression methods, and their practical applications to multimedia data compressions including speech and image.

ECE738 Advanced Wireless Communication Theory [고급 무선 통신 이론]

This course covers the fundamentals of wireless communication underpinning the advances in leading-edge wireless technologies. The emphasis is on theory and algorithms for the most salient concepts including multi-input multi-output (MIMO) and OFDMA/CDMA and forefronts of commercialized systems such as WiFi and LTE-A.

ECE752 Advanced Integrated System Design [아날로그 시스템 디자인]

Students will study the design of analog systems using CMOS and bipolar technology. A higher level of design for analog and digital systems is presented. Practical examples for communication microsystems are presented.

ECE754 Low Noise Electronic System Design [저잡음 전자시스템 디자인]

This course is a study of the sources of noise found in electronic instrumentation. It teaches the recognition of sources of noise and the design techniques to achieve noise reduction.

ECE755 Frequency Synthesizers [주파수 발생기 이론]

Frequency synthesizers generate many discrete RF frequencies from one reference frequency. General synthesizers, digital PLL, direct digital, and hybrid synthesizers are covered.

ECE756 Electronic Oscillators [전자 발진기 이론]

Starting from non-linear differential equations, this course presents a systematic approach to the design of electronic oscillators. Design of negative resistance and feedback oscillators is discussed. CAD techniques are employed.

ECE772 Nanoscale Electronic Devices [나노전자소자]

This course is intended to introduce the fundamental scientific principles and technologies of nano-scale electronic devices. We will start with discussing the basic and key concepts of semiconductor device physics, and then applying those concepts for several conventional electronic devices such as p-n junction, bipolar transistor, Schottky diode, and MOSFET. Finally, we will extend our scope to the new types of nanoscale devices that are currently under extensive research and development as candidates to overcome the limitation of current planar CMOS and flash memories, such as 3D structure transistors (dual-, tri-gate), CNT and nanowire applications, MRAM, FRAM and spintronics, etc.

ECE773 Compound Semiconductor Devices [화합물 반도체 소자]

This course covers the material properties of III-V compound semiconductor and device fabrication process technologies including epitaxy, doping, and etching, bandgap engineering. Also, several important applications of compound semiconductor such as HEMT will be discussed in depth.

ECE774 Plasma in Device Manufacturing [플라즈마 공정]

Plasma is widely used for contemporary materials processing. In this course, the plasma processing of semiconductors and other electronic devices are introduced.

ECE775 Practical RF Engineering [실용 RF공학]

This course intends to offer hands-on experiences in RF engineering field. Frequency range from RF, microwave, millimeterwave, and up to THz wave is going to be covered in the measurements. Basic measurements such as Smith chart, S-parameter, resonance, etc for the purpose of understanding high frequency phenomena are provided. Students are required to take pre-requisites for this course.

ECE778 Electronic Carrier Transport Physics [전하 수송 물리]

The purpose of this course is to extend knowledge to the advanced electronic carrier transport physics, which include conductance from transmission function, Green's functions, tunneling and Non-equilibrium Green's function (NEGF) formalism.

ECE782 Nanophotonics [나노광자학]

This course intends to provide and discuss advanced knowledge of nanophotonics. It covers a few current topics related to nanophotonics. The topics include: surface-plasmon polariton, plasmonic waveguides, plasmonic waveguide devices, nanophotonic devices like photonic crystals.

ECE830~ECE834 Advanced Topics in Communication, Control, and Signal Processing I~V [통신,제어 및 신호처리 고급토픽 I~V]

This course introduces advanced research topics in the field of Communication, Control, and Signal Processing I~V.

ECE835~ECE839 Advanced Topics in Electronic Design and Applications I~V [전자회로 설계및 응용 고급토픽 I~V]

This course introduces advanced research topics in the field of Electronic Design and Applications I~V.

PHY503 Electrodynamics I [전기역학 I]

In this course we provide the student with the basic knowledge of electrodynamics, which are necessary to understand the advanced electrodynamics. The electrostatics, magnetostatics, boundary value problems, Maxwell equations, and wave propagations are covered.

PHY505 Quantum Mechanics I [양자역학 I]

This course is intended to improve our understanding of the basic principles and theoretical schemes of quantum mechanics by revisiting the topics covered in undergraduate quantum mechanics with more systematic and advanced mathematical formalism. The basic assumptions, Dirac notation, Hilbert space, Schrodinger equation, harmonic oscillator, angular momentum, spin and identical particles will be discussed.

PHY561 Plasma Physics [플라즈마 물리]

The cutting-edge technologies in nano-scales strongly require proper tools of diagnostics, the highly coherent and high-brightness X-ray. In this course students study the application of laser-plasma for table-top particle acceleration and X-ray generation for that purpose. In addition to that, the nuclear fusion methods for future energy by magnetic and inertial confinement are also introduced.

PHY723 Interface Physics of Electronic Devices [전자소자 계면물리]

The interfaces between different materials in an electronic device take crucial roles in determining the functionality and efficiency of the device. This course introduces the basic physics of various interface phenomena occurring in electronic devices, and also the experimental methods characterizing them as well. Particularly, it discusses the electronic band structure and charge/spin transport (lateral, vertical) at interfaces, and their relations to the operational mechanisms of various actual electronic devices.

PHY761 Physics of Vacuum Electron Devices [진공 전자소자 물리]

This course covers basic principles of high power microwave/millimeterwave/THz wave sources and their applications. Especially, the course is focussed in vacuum device based sources such as klystrons, TWTs, and gyrotrons. Students are required to take pre-requisites for this course.

PHY763 Laser-Plasma Physics [레이저-플라즈마 물리]

This course is composed of two parts. Before the midterm, diverse subjects of laser-plasma interactions including the scattering, energy absorption by Bremsstrahlung, particle acceleration, nuclear fusion, terahertz generation, wakefield, and other nonlinear interactions are briefly introduced. After the midterm, specialized lectures are given on the laser-plasma-based particle acceleration and its numerical simulation.

PHY765 Nuclear Fusion Engineering [핵융합 공학]

This course intends to cover basic principles of nuclear fusion and broad knowledge of the current technology in the world. Physics of fusion plasmas and beam-wave interaction are the main themes of the course. Students are required to take pre-requisites for this course.

ECS571 Organic Electronics [유기일렉트로닉스]

This course will cover the basic concepts, mechanisms, and special issues in organic electronics. Based on understanding of the basic properties of inorganic semiconductors, this course will focus on the applications using organic semiconductors such as organic light-emitting diodes, organic solar cells, and organic field-effect transistors.

ECE590 ECE Graduate Seminar [ECE 대학원 세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D level by invited talks of the experts in various related scientific or engineering fields, and also possibly by presentations of the students in the course to exchange their own ideas and updated information for creative and fine-tuned achievements.

ECE690 Master's Research [석사논문연구]

This course is related to the student's graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

ECE890 Doctoral Research [박사논문연구]

This course is related to the student's graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Computer Engineering

□ Computer Engineering [CE]

Computer Engineering (CE) is the field of study that blends principles, theories, and applications of computer technologies that improve access to information. It encompasses computer programming, theoretical computer science, operating systems, databases, computer architecture, artificial intelligence, computer graphics, and human computer interaction just to name a few. Computer science and engineering is not just about how to write computer programs or how to use them, but it tries to tackle the fundamental question - how and what computation can be efficiently automated and implemented.

• Computer Systems & Network

Today's information systems are connected through wired/wireless communications with each other. The fundamental challenges in this area are how to build networked computer systems, and how to design scalable, predictable, reliable, trustable, and yet cost-effective systems, in both hardware and software. Advances in this area are critical to meet the exploding demands of tomorrow's applications arising in other sciences and engineering as well as in our daily lives. UNIST research in this area includes embedded systems, parallel and distributed computing, real-time systems, operating system virtualization, mobile computing, the Internet computing, and ubiquitous computing.

• Theoretical Computer Science

Computer science and engineering does not always involve computers. It is as if music is not just about creating musical instruments or how to play them. In fact, computer science problems have been investigated even before modern computers were built. This field focuses on analysis of algorithms, data structures, computational complexity theory, computational biology, computational geometry, information theory, cryptography, algebra, automata theory, and more mathematical aspects of computation.

• Applied Computing

The scope of applied computing is quite broad, covering many application fields that strongly emphasize practical purpose. Thanks to the exponential growth in computer technology, Information Technology (IT) has spread to virtually every corner of our modern world, creating new sciences and engineering such as: artificial intelligence, data mining, semantic web, security and privacy, bio-medical informatics, computational biology, telematics, robotics, and interactive technology spanning computer graphics, computer vision, and human computer interaction. UNIST's interdisciplinary research strategy is very well suited to the research demand of this area.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 29 credits	at least 24 credits	at least 5 credits
Doctoral Program	at least 33 credits	at least 18 credits	at least 15 credits
Combined Master's-Doctoral Program	at least 55 credits	at least 36 credits	at least 19 credits

□ Curriculum ▶ Computer Engineering

Course is	Classification	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	Lecture	ECE506	Introduction to Optimization	최적화 이론	3-3-0	ECE533	
		ECE507	Probabilistic Graphical Models	확률 그래프 모델	3-3-0		
		ECE508	Automated Planning	자동 플래닝	3-3-0		
		ECE509	Mobile Networks	모바일 네트워크	3-3-0		
		ECE510	System Software	시스템소프트웨어	3-3-0		
		ECE511	Computer Architecture	컴퓨터 구조	3-3-0	CSE301	O
		ECE513	Formal Languages and Automata	형식언어 및 오토마타	3-3-0		
		ECE515	Algorithm Design	알고리즘 디자인	3-3-0		
		ECE516	Compiler Design	컴파일러 디자인	3-3-0	CSE211, CSE221	
		ECE517	Distributed Systems	분산시스템	3-3-0	CSE221, CSE311	
		ECE518	Modern Cryptography	현대암호학	3-3-0	CSE232	
		ECE519	Massively Parallel Programming	대규모 병렬처리 프로그래밍	3-3-0		
		ECE520	Computational Geometry	계산 기하학	3-3-0		
		ECE521	Intelligent Agents and Electronic Marketplace	지능 에이전트와 전자 상거래	3-3-0		
		ECE522	Data Visualization	데이터 가시화	3-3-0		
		ECE523	Human Computer Interaction	인간 컴퓨터 상호작용	3-3-0		O
		ECE524	Software Engineering	소프트웨어 공학	3-3-0		
		ECE525	Parallel Computing	병렬 컴퓨팅	3-3-0		O

Course is	Classification	Course No.	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
		ECE526	Programming Language Design	프로그래밍 언어 설계	3-3-0		
		ECE527	Embedded System Design	내장형 시스템 설계	3-3-0		O
		ECE528	Cloud Computing	클라우드 컴퓨팅	3-3-0		
		ECE529	Autonomous Robots	자율 로봇	3-3-0		O
		ECE543	Computer Vision	컴퓨터 비전	3-3-0		O
		ECE610	Special Topics in Computer Engineering I	컴퓨터공학 스페셜 토픽 I	3-3-0		
		ECE611	Special Topics in Computer Engineering II	컴퓨터공학 스페셜 토픽 II	3-3-0		
		ECE612	Special Topics in Computer Engineering III	컴퓨터공학 스페셜 토픽III	3-3-0		
		ECE613	Special Topics in Computer Engineering Ⅳ	컴퓨터공학 스페셜 토픽 Ⅳ	3-3-0		
		ECE614	Special Topics in Computer Engineering Ⅴ	컴퓨터공학 스페셜 토픽 Ⅴ	3-3-0		
		ECE710	Natural Language Processing	자연언어처리	3-3-0		
		ECE712	Advanced Computer Systems	고급 컴퓨터 시스템	3-3-0		
		ECE713	Computer and Communication Networks	컴퓨터 통신 네트워크	3-3-0		
		ECE714	Artificial Intelligence	고급인공지능	3-3-0		
		ECE715	Advanced Computer Graphics	고급 컴퓨터 그래픽스	3-3-0		
		ECE716	Advanced Database	고급데이터베이스	3-3-0		
		ECE717	Computational Complexity	계산복잡도 이론	3-3-0	ECE513	
		ECE719	Information Retrieval	정보 검색	3-3-0		
		ECE721	Bioinformatics	바이오 인포매틱스	3-3-0		
		ECE722	Discrete Stochastic Processes	이산 확률 프로세스	3-3-0		
		ECE810	Advanced Topics in Computer Engineering I	컴퓨터공학 고급 토픽 I	3-3-0		
		ECE811	Advanced Topics in Computer Engineering II	컴퓨터공학 고급 토픽 II	3-3-0		
		ECE812	Advanced Topics in Computer Engineering III	컴퓨터공학 고급 토픽 III	3-3-0		
		ECE813	Advanced Topics in Computer Engineering Ⅳ	컴퓨터공학 고급 토픽 Ⅳ	3-3-0		
		ECE814	Advanced Topics in Computer Engineering Ⅴ	컴퓨터공학 고급 토픽 Ⅴ	3-3-0		
Required	Research	ECE590	ECE Graduate Seminar	ECE 대학원 세미나	1-1-0		
		ECE690	Master's Research	석사논문연구	가변학점		
		ECE890	Doctoral Research	박사논문연구	가변학점		

□ Description

ECE506 Introduction to Optimization [최적화 이론]

Introduce basic optimization theory and methods, with applications in systems and control. The course will cover constrained and unconstrained optimization, linear programming, various algorithms and search methods for optimization, and their analysis. Examples from various engineering applications are given. Prerequisite of linear algebra and calculus of several variables.

ECE507 Probabilistic Graphical Models [확률 그래프 모델]

This course studies a class of graphical models that represent joint probability distributions of random variables. The topics include conditional dependence of random variables, statistical inference, message passing algorithm, Nash equilibrium, (Non-)cooperative game, Bayesian network, Conditional Random Fields.

ECE508 Automated Planning [자동 플래닝]

Planning is a fundamental ability for intelligent agents to act successfully in an environment.
Automated planning has been an active area of research in artificial intelligence for over three decades. Planning techniques have been applied in a number of domains including robotics, process planning, web-based information gathering, and spacecraft mission control. This course aims to introduce the basic algorithms and techniques in AI planning research, with an overview of a wide variety of planning paradigms and applications.

ECE509 Mobile Networks [모바일 네트워크]

This course provides the fundamental concepts and algorithms in mobile networks involving cellular networks, mobile ad-hoc networks, and opportunistic networks. The topics covered in this course include naming, routing and transport layer protocols designed and optimized for mobile networks.

ECE510 System Software [시스템소프트웨어]

This course introduces fundamental principles behind diverse system software such as linker, loader, debugger, performance profiler and virtualization hypervisor.

ECE511 Computer Architecture [컴퓨터 구조]

This course provides the in-depth understanding of the design issues of processors, memory hierarchy, data bus architectures, and storage technologies.

ECE513 Formal Languages and Automata [형식언어 및 오토마타]

This course introduces the theory of formal languages and automata. Finite automata, regular expression, context-free grammar, pushdown automata, turing machine and computability will be covered in this course.

ECE515 Algorithm Design [알고리즘 디자인]

This course provides the practical design and analysis techniques of algorithms. Parallel programming, linear programming, dynamic programming, approximation programming, randomization, amortized analysis, probabilistic analysis, and other advanced algorithm concepts will be dealt with in this course.

ECE516 Compiler Design [컴파일러 디자인]

Through this course, students study basic rules and implementation considerations in implementing a programming language. More details on grammar checks for program syntax, implementation optimization, relations between programming languages and compilers, the role of interpreters, run-time systems, and semantically accurate expressions are also covered.

ECE517 Distributed Systems [분산시스템]

This course studies the key design principles of distributed systems, which are collections of independent networked computers that function as single coherent systems. Covered topics include communication protocols, processes and threads, naming, synchronization, consistency and replication, and fault tolerance. This course also examines some specific real-world distributed systems case studies, ranging from the Internet to file systems. Class discussion is based on readings from the textbooks and research papers.

ECE518 Modern Cryptography [현대암호학]

This is an introductory course on cryptography, covering fundamental cryptographic notions including pseudorandom generators, symmetric-key encryption, message authentication codes, public-key encryption, and digital signatures. Special emphasis is given to rigorous definition and provable security.

ECE519 Massively Parallel Programming [대규모 병렬처리 프로그래밍]

This course introduces state-of-the-art programming techniques for massively parallel computing systems, such as graphics processing units (GPU). The course covers basic parallel programming theories and several programming APIs such as NVIDIA CUDA, OpenCL, and MPI.

ECE520 Computational Geometry [계산 기하학]

Computational geometry studies efficient algorithms and data structures for solving large scale geometry problems. The topics to be covered include computational complexity, convex hull, line segment intersection, Delaunay triangulation, Voronoi diagram, Euclidean shortest path, mesh generation, and so on. The main goal of the course is to make students familiar with the fundamental data structures for geometric objects and train them to develop the efficient data structures. The knowledge and insight about algorithms and data structures gained from this course can be applied to various computer science research - database management systems, distributed systems, geographic information systems, computer graphics, etc.

ECE521 Intelligent Agents and Electronic Marketplaces [지능 에이전트와 전자 상거래]

An intelligent agent is an Artificial Intelligence program that situates in a simulated or physical environment and operates on behalf of a user to achieve certain goals or maximize a performance measure. This course provides a board introduction to the design of intelligent agents, with emphasis on agents in electronic markets. We will also cover computational and game-theoretic topics related to the foundations of electronic marketplaces. Topics include agent architectures and modeling, game theoretic analysis of multiagent systems, automated mechanism design, auction and exchange design, computational social choice, incentive-compatibility, privacy in mechanism design, negotiation and bargaining, reputation systems, prediction markets, advertising markets, and electricity markets.

ECE522 Data Visualization [데이터 가시화]

In this class, we will learn introductory visualization algorithms and data structures frequently used in scientific and information visualization research. The class will cover basic data representation, scalar and vector visualization, image and volume visualization, and information visualization. We will also cover widely used image processing and visualization libraries, such as ITK and VTK.

ECE523 Human Computer Iteraction [인간 컴퓨터 상호작용]

This course introduces the concepts of Human-Computer Interaction (HCI) that enables computer scientists to design systems that consider human factors. In this course, students will learn what are the good and bad design from the perspective of users, and analytic and empirical evaluation methods.

ECE524 Software Engineering [소프트웨어 공학]

Software engineering is a sub field of computer science that studies how to analyze and understand software requirements, how to build cost-effective designs and solutions to the problems, and how to manage project teams. This course introduces the fundamentals of software life cycle, software specifications, software project management methodologies, and the application of engineering tools.

ECE525 Parallel Computing [병렬 컴퓨팅]

Parallel computing enables many computations to be carried out concurrently on parallel platforms ranging from multi-core architectures to high-performance clusters. This course introduces parallel architectures, parallel algorithms, parallel programming models and libraries (Pthreads, MPI, PVM, OpenMP), scalability, locking protocols, data localization, and the theoretical models for parallel computation.

ECE526 Programming Language Design [프로그래밍 언어 설계]

This course introduces concepts of the design of high-level programming languages. It includes various programming language features, structural operational semantics, denotational semantics, logic semantics, algebraic implementation of data types, attribute grammar formalism, and axiomatic semantics.

ECE527 Embedded System Design [내장형 시스템 설계]

This course will introduce the fundamentals of embedded system design. Students are required to design and implement an application for an embedded systems platform, and to investigate performance tuning.

ECE528 Cloud Computing [클라우드 컴퓨팅]

This course is to understand key concepts and techniques of cloud computing and virtualization, which is the core technology for cloud computing. This course will cover interesting topics including x86 virtualization, virtual machine management techniques, cloud resource management and optimization, big data analysis on cloud, and high performance computing on cloud.

ECE529 Autonomous Robots [자율 로봇]

Robotics is a topic in artificial intelligence which focuses on the physical aspect of intelligence. A machine that can interact successfully with our physical world is an important incarnation of an intelligent agent. In this course, we will introduce some basic algorithms for robotic research. Topics include, but are not limited to: motion control (PID control), observers and tracking (Kalman filters), localization (particle filters, SLAM), vision (segmentation and object detection), walking (zero-moment point), action and sensor modeling (STRIPS planning, optimization of humanoid walk), path planning (Rapidly-exploring Random Trees), behavior architectures (subsumption architecture), multi-robot coordination (multi-robot patrolling), reinforcement learning (Q-learning, multi-armed bandit), multi-robot interaction (socially intelligent robots), applications (autonomous vehicles), and social implications (Isaac Asimov's "Three laws of Robotics").

ECE543 Computer Vision [컴퓨터 비전]

This course aims at learning how to extract valuable information from visual scenes using computers. Topics may include the basic theories for capturing images by cameras, human visual perception, filtering, edge detection, segmentation, stereo, motion analysis, feature extraction, and object recognition.

ECE610 Special Topics in Computer Engineering I [컴퓨터공학 스페셜 토픽 I]

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

ECE611 Special Topics in Computer Engineering II [컴퓨터공학 스페셜 토픽II]

This course introduces new research topics in the field of Computer Engineering

ECE612 Special Topics in Computer Engineering III [컴퓨터공학 스페셜 토픽 III]

This course introduces new research topics in the field of Computer Engineering

ECE613 Special Topics in Computer Engineering IV [컴퓨터공학 스페셜 토픽 IV]

This course introduces new research topics in the field of Computer Engineering

ECE614 Special Topics in Computer Engineering IV [컴퓨터공학 스페셜 토픽 IV]

This course introduces new research topics in the field of Computer Engineering

ECE710 Natural Language Processing [자연언어처리]

This course introduces the theory and techniques to process natural language with computer systems.

ECE712 Advanced Computer Systems [고급 컴퓨터 시스템]

This course is to introduce the core concepts in operating systems and distributed systems, and study recent research topics on computer systems. This course will cover topics including classic systems, large scale systems, multicore systems, and fault tolerance.

ECE713 Computer and Communication Networks [컴퓨터 통신 네트워크]

This course provides in-depth understanding on the design and implementation of computer and communication networks. It covers a variety of analytical techniques to understand system performance, and advanced networking technologies for performance improvement in wired and wireless environment.

ECE714 Artificial Intelligence [고급인공지능]

This course provides diverse techniques for designing intelligent decision-making machines. The topics covered in this course are machine learning, expert systems, neural networks, game theory, operations research, and heuristic algorithms.

ECE715 Advanced Computer Graphics [고급 컴퓨터 그래픽스]

This course is an advanced course on the state-of-the-art 3D computer graphics theories and applications. The course will review recent computer graphics and visualization research articles about 3D modeling, rendering, image processing, and volume graphics.

ECE716 Advanced Database [고급데이터베이스]

This course covers database management system design principles and techniques. Possible topics include internal design of DBMS, indexing, query optimization, parallel databases, distributed databases, geographic information systems, data intensive computing, and big data processing. In the first half of the course, we will review internal design of DBMS. In the second half, we will read milestone papers in DB history as well as the state-of-the-art papers mainly focusing on emerging technologies.

ECE717 Computational Complexity [계산복잡도 이론]

Computational complexity theory studies how much resource (time or memory, for example) is required to solve a given computational problem. Topics covered in this class includes time complexity, space complexity, randomized computation, quantum computation, and interactive proofs.

ECE719 Information Retrieval [정보 검색]

This course introduces theory and design of text-based information retrieval systems. It discusses the models and methodologies used in information retrieval systems, statistical characteristics, representation of information, clustering algorithms, collaborative filtering, automatic text categorization, etc.

ECE721 BioInformatics [바이오 인포매틱스]

Bioinformatics studies methods for storing, retrieving, and analyzing biological data, such as protein sequence, structure, and genetic interactions. It deals with various computer science fields including algorithms, databases, information systems, artificial intelligence, data mining, image processing, and discrete mathematics.

ECE722 Discrete Stochastic Processes [이산 확률 프로세스]

The objective of this class is to help students develop the understanding necessary to apply stochastic models to a variety of problems in engineering, science and operations research. The course contains many examples and case studies designed to build insight into the structure of stochastic processes and their impact on real systems, especially in the broad area of communication and networking.

ECE810 Advanced Topics in Computer Engineering I [컴퓨터공학 고급 토픽 I]

This course introduces advanced research topics in the field of Computer Engineering I

ECE811 Advanced Topics in Computer Engineering II [컴퓨터공학 고급 토픽 II]

This course introduces advanced research topics in the field of Computer Engineering II

ECE812 Advanced Topics in Computer Engineering III [컴퓨터공학 고급 토픽 III]

This course introduces advanced research topics in the field of Computer Engineering III

ECE813 Advanced Topics in Computer Engineering Ⅳ [컴퓨터공학 고급 토픽Ⅳ]

This course introduces advanced research topics in the field of Computer Engineering Ⅳ

ECE814 Advanced Topics in Computer Engineering Ⅴ [컴퓨터공학 고급 토픽 Ⅴ]

This course introduces advanced research topics in the field of Computer Engineering Ⅴ

ECE590 ECE Graduate Seminar [ECE 대학원 세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D level by invited talks of the experts in reak scientific or engineering fields, and also possibly by presentataions of the students in the course to exchange their own ideas and updated information for creative and fine-tuned achievements

ECE690 Master's Research [석사논문연구]

This course is related to the student's graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

ECE890 Doctoral Research [박사논문연구]

This course is related to the student's graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Mechanical Engineering

□ Mechanical Engineering [MEN]

Mechanical 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 engineering have made dramatic advances and high impacts on the global economies and the standard of living. In the track of mechanical engineering, students are educated and trained to learn the underlying principles of mechanical 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, MEMS, biomedical products, controls and mechatronics, acoustics, tribology and so on.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's–Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

□ Curriculum ▶ Mechanical Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Required	MEN590	Research	The Seminars	세미나	1-1-0		
Required	MEN690	Research	Master's Research	석사논문연구	Value of credit		
Required	MEN890	Research	Doctoral Research	박사논문연구	Value of credit		
Elective	MEN500	Lecture	Advanced Numerical Methods	수치해석특론	3-3-0		
Elective	MEN501	Lecture	Continuum Mechanics	연속체역학	3-3-0		
Elective	MEN502	Lecture	Advanced Mechanical Engineering Analysis	기계공학해석특론	3-3-0		
Elective	MEN510	Lecture	Advanced Thermodynamics	열역학특론	3-3-0		
Elective	MEN511	Lecture	Advanced Heat Transfer	열전달특론	3-3-0		
Elective	MEN512	Lecture	Advanced Combustion	연소특론	3-3-0		O
Elective	MEN520	Lecture	Advanced Fluid Mechanics	유체역학특론	3-3-0		
Elective	MEN521	Lecture	Microfluidics and Nanofluidics	미세유체역학	3-3-0		O
Elective	MEN522	Lecture	Computational Thermofluid Engineering	전산열유체공학	3-3-0		
Elective	MEN523	Lecture	Advanced Therofluid Measurement	열유동 계측특론	3-3-0		O
Elective	MEN524	Lecture	Aerosol Technology	에어로졸특론	3-3-0		O
Elective	MEN530	Lecture	Advanced Solid Mechanics	고체역학특론	3-3-0		
Elective	MEN531	Lecture	Finite Element Method	유한요소법특론	3-3-0		O
Elective	MEN535	Lecture	Computational Nanomechanics	전산나노역학	3-3-0		O
Elective	MEN551	Lecture	Computer-Aided Design	전산기원용설계	3-3-0		O
Elective	MEN552	Lecture	Manufacturing Processes and Systems	생산공정 및 시스템	3-3-0		
Elective	MEN553	Lecture	Manufacturing and Process Engineering	생산공학특론	3-3-0		
Elective	MEN554	Lecture	Machine Tool Analysis and Control	공작기계 해석 및 제어	3-3-0		
Elective	MEN556	Lecture	Laser Material Interaction and Processing I	레이저 재료 상호작용 및 가공 I	3-3-0		O

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	MEN557	Lecture	Polymer and Composite Manufacturing	고분자 및 복합재료 제조공정	3-3-0		
Elective	MEN558	Lecture	Micro and Nanofabrication	MEMS특론	3-3-0		O
Elective	MEN559	Lecture	Bio MEMS	바이오MEMS	3-3-0		O
Elective	MEN570	Lecture	Advanced Dynamics	동역학특론	3-3-0		
Elective	MEN571	Lecture	Robotics	로봇공학	3-3-0		O
Elective	MEN572	Lecture	Nonlinear Systems	비선형 시스템	3-3-0		
Elective	MEN573	Lecture	Advanced Control Systems I	고급제어 I	3-3-0		O
Elective	MEN574	Lecture	Real-Time Applications of Control Systems	제어 시스템 구현	3-3-0		O
Elective	MEN575	Lecture	Electromechanical dynamics	전자기기 동력학	3-3-0		O
Elective	MEN732	Lecture	Failure Analysis and Design for Reliability	파괴해석과 신뢰성 설계	3-3-0		
Elective	MEN733	Lecture	Mechanics of Polymer Solids and Fluids	고분자역학	3-3-0		
Elective	MEN734	Lecture	Scanning Probe Microscopy	주사 탐침 현미경	3-3-0		
Elective	MEN755	Lecture	Net Shape Manufacturing	소성가공	3-3-0		
Elective	MEN756	Lecture	Laser Material Interaction and Processing II	레이저 재료 상호작용 및 가공 II	3-3-0		O
Elective	MEN772	Lecture	Advanced Analytic Kinematics	해석기구학특론	3-3-0		
Elective	MEN773	Lecture	Advanced Control Systems II	고급제어 II	3-3-0		O
Elective	MEN791	Lecture	Special Topic I	기계공학특론 I	3-3-0		
Elective	MEN792	Lecture	Special Topic II	기계공학특론 II	3-3-0		
Elective	MEN793	Lecture	Special Topic Ⅲ	기계공학특론 Ⅲ	3-3-0		
Elective	MEN794	Lecture	Special Topic Ⅳ	기계공학특론 Ⅳ	3-3-0		
Elective	MEN795	Lecture	Special Topic Ⅴ	기계공학특론 Ⅴ	3-3-0		
Elective	MEN796	Lecture	Special Topic Ⅵ	기계공학특론 Ⅵ	3-3-0		
Elective	MEN797	Lecture	Special Topic Ⅶ	기계공학특론 Ⅶ	3-3-0		

□ Description

MEN500 Advanced Numerical Methods [수치해석특론]

This course focuses on the modern computational and mathematical techniques needed for solving engineering problems. In this course, numerical methods for solving sets of nonlinear algebraic equations, ordinary differential equations, and differential-algebraic (DAE) systems are covered. The use of these techniques will be demonstrated.

MEN501 Continuum Mechanics [연속체역학]

This is a core course for graduate study in Mechanical Engineering. This course provides knowledge of the fundamental, comprehensive concepts of the mechanics of continua, including tensors, rigorous definitions of stress and strain, laws of thermodynamics for a continuum, and fundamentals of behavior of solids and fluids.

MEN502 Advanced Mechanical Engineering Analysis [기계공학해석특론]

This course introduces application of mathematical methods to the description and analysis of systems in mechanical engineering.

MEN510 Advanced Thermodynamics [열역학특론]

This course reviews the fundamentals of macroscopic thermodynamics and then introduces statistical thermodynamics that describes thermodynamic phenomena and analyzes them from the standpoint of microscopic quantities. Topics include the basic principles of thermodynamics, classical kinetic theory, the fundamentals of quantum mechanics, Bose-Einstein and Fermi-Dirac quantum statistics, partition functions, and the Schrodinger equation for the modes of translation, rotation, vibration, etc. Various application methods enabling the estimation of thermodynamic properties will be studied.

MEN511 Advanced Heat Transfer [열전달특론]

This course reviews the fundamentals of heat transfer and then studies more profound convective heat transfer and radiation. It further discusses the cooling system using nanofluids, applications of heat transfer to biomedical devices, micro-/nano heat transfer system, and semiconductor cooling using electrokinetics and mass transfer.

MEN512 Advanced Combustion [연소특론]

This course covers chemical thermodynamics, chemical kinetics, oxidation mechanism of fuels, environment combustion such as NOx and soot, and conservation equations for reacting flows. Based on the basic knowledge, the characteristics of premixed flames, nonpremixed flames, and ignition/extinction of flames, and turbulent combustion and modeling will be discussed.

MEN520 Advanced Fluid Mechanics [유체역학특론]

This course teaches mathematical and physical foundations of fluid mechanics. The first part of the course is a brief review of tensor analysis, followed by rigorous derivations of continuity equation, momentum equation, and energy equation for Newtonian fluids. After that, topics such as low Reynolds number flows, laminar flows, turbulent flows, boundary layers, vorticity dynamics, and irrotational flows are covered with practical examples.

MEN521 Microfluidics and Nanofluidics [미세유체역학]

Microfluidics and nanofluidics is the study of how fluids behave at the micro and even nano scale. This course is aimed primarily at graduate students in science and engineering who have some background in or are interested in learning more about microfluidics. In this course not only do we study the basic physics such as low Reynolds number fluid mechanics, electrokinetics and heat and mass transfer, but we also discuss how physical phenomena are implemented in microfluidic devices. We further discuss microfabrication techniques necessary for building bio-compatible microfluidic devices and organic, biological samples such as DNA, protein and cells.

MEN522 Computational Thermofluid Engineering [전산열유체공학]

This course introduces basic methods to solve fluid mechanics problems, heat flow problems, and coupled fluid-flow & heat-flow problems using the techniques of Computational Fluid Dynamics (CFD). A focus is placed on incompressible fluid flows and accompanying heat flows, and students will deepen their understanding by writing CFD programs through homework assignments and course projects.

MEN523 Advanced Thermofluid Measurement [열유동계측특론]

In this course, we are able to widen and deepen our understanding of thermofluid measurement methods based on the fundamentals of heat transfer and fluid mechanics. We will learn how to measure flow fields and temperature fields by using the principles of PIV (particle image velocimetry) and a hotwire method. We will also learn how to use LabVIEW and other measurement equipment.

MEN524 Aerosol Technology [에어로졸특론]

The objective of this class is to understand fundamental knowledge of gasborne particles (aerosols) and their physical/chemical/thermal/optical/electric properties. Also, the generation, collection, and measurement of aerosols will be covered along with the basic concepts and applications of biological aerosols (bioaerosols).

MEN530 Advanced Solid Mechanics [고체역학특론]

In this course, we will gain the ability to solve general solid mechanics problems, by defining the stress and strain based on the tensor theory and by understanding the governing equations such as equilibrium, constitutive, and compatibility equations between stress and strain. In addition, the special problems and their theoretical solutions in solid mechanics will be introduced.

MEN531 Finite Element Method [유한요소법특론]

In this course, the theory and formulation behind finite element method will be introduced. To gain hands-on experience of finite element method, practical applications in engineering will be covered.

MEN535 Computational Nanomechanics [전산나노역학]

In this course, classical molecular dynamics and quantum simulation methods will be discussed in detail as general computational tools to explore nanomaterials and nanosystems. For this, basic characteristics of nanomaterials and numerical algorithmswill be introduced. Through a numerical project, we will broaden our understanding of nanomaterials and nanomechanics.

MEN551 Computer-Aided Design [전산기원용설계]

This course introduces fundamentals of CAD, including geometric and solid modeling, parametric representations, features, and human-machine interactions. Applications to design, analysis, and manufacturing will be covered.

MEN552 Manufacturing Processes and Systems [생산공정 및 시스템]

To provide graduate students with an integrated treatment of the analysis of traditional and non-traditional manufacturing processes, their selection and planning, within an economic framework, this course will cover materials processing analysis and selection, manufacturing systems design and economic analysis.

MEN553 Manufacturing and Process Engineering [생산공학특론]

This course introduces the basic design techniques of various manufacturing tools, including cutting tools, forming dies, inspection gages, jigs and fixtures. The course also covers the fundamental planning principles and techniques of manufacturing processes, including routing planning and operations design. Through term projects performed in teams, students integrate the fundamental principles into solving practical manufacturing process problems within an economic framework.

MEN554 Machine Tool Analysis and Control [공작기계 해석 및 제어]

To develop an advanced understanding of machining processes in the context of machinery, mechanics, dynamics, monitoring techniques, and control strategies. In this course, mechanics and dynamics of machining, machine tool components and structures, sensors and controls of machine tools, machine process planning and optimization will be covered.

MEN556 Laser Material Interaction and Processing I [레이저 재료 상호작용 및 가공 I]

In this course, students learn the basic principles of lasers and various interaction mechanisms in laser material interaction. Based on this basic knowledge, students will also learn various areas of laser materials processing. Topics include laser interaction with various materials (such as metals, semiconductors, dielectrics, and biological tissues), laser cutting, laser drilling, laser welding, laser heat treatment, laser cladding, and laser micromachining.

MEN557 Polymer and Composite Manufacturing [고분자 및 복합재료 제조공정]

This course is designed to expose graduate students to a variety of processing methods for polymers and polymer-matrix composites. Polymer processing methods include injection molding, extrusion, fiber spinning, filament winding, etc. for both thermoplastic and thermosetting polymers. Topics in polymer-matrix composites include not only traditional fiber-reinforced composites, but also design, manufacturing, characterization, and application of such cutting-edge material systems as high-temperature, multifunctional composites and nanocomposites. Integral components to this course are modeling- and simulation-based material property prediction and cost (or affordability) analysis, which will enable students to design and manufacture polymers and polymer-matrix composites within an economic framework.

MEN558 Micro and Nanofabrication [MEMS특론]

MEMS/NEMS technologies are adopted in a variety of mechanical, electronic devices and bio-sensors. This course introduces basic principles of conventional microfabrication techniques for MEMS device fabrication and includes their applications and some case studies. MEMS is a typical interdisciplinary research area so that the application of this course is expected to be extended to research areas such as electronic engineering, biochemistry, chemistry, physics, medical science and etc.

MEN559 Bio MEMS [바이오 MEMS]

This course organizes its contents along a bottom-up biological pathway made by nature so that we will discuss the impacts made by innovative bioMEMS/NEMS technologies on the development of biology: genomics, proteomics, metabolomics, signaling pathway modulation, and tissue and artificial organ engineering. Not only we will learn/review general biology and bioMEMS but also we will discuss what engineers can build for biologists/scientists and what they require us to develop.

MEN570 Advanced Dynamics [동역학특론]

This course will cover the following: kinematics and kinetics of plane and three-dimensional motion, Coriolis acceleration, general methods of linear and angular momentum, central force motion, gyrodynamics, generalized coordinates, and Lagrange's equations. Prerequisite skills are a basic knowledge of fundamental calculus and differential equations

MEN571 Robotics [로봇공학]

This course aims at teaching students basic mathematical and computational tools for modeling and analysis of robotic systems. Students will learn to identify, model, analyze, design, and simulate robotic systems, including their kinematics, dynamic responses, and control. In addition, students will gain an understanding of sensory and mechanical components integrated within a robotic system.

MEN572 Nonlinear Systems [비선형 시스템]

Introduction to nonlinear phenomena: multiple equilibria, limit cycles, bifurcations, complex dynamical behavior. Planar dynamical systems, analysis using phase plane technique. Describing fuction. Input-output analyssi and stablitity. Lyapunov stability theory. feedback linearization.

MEN573 Advanced Control Systems I [고급제어 I]

Input-output and state space representation of linear time-invariant continuous and discrete time dynamic systems. Design and analysis of single and multi-variable feedback control systems in time and frequency domain. Controllability, observability, and stability. System modelling and identification. State observer. Linear Quadratic Optimal Control.

MEN574 Real-Time Applications of Control Systems [제어 시스템 구현]

Mini and micro computers, operating in real time, have become ubiquitous components in engineering systems. The purpose of this course is to build competence in the engineering use of such systems through lectures stressing small computer structure, programming, and output/input operation, and through laboratory work with mini and micro computer systems.

MEN575 Electromechanical dynamics [전자기기 동력학]

Electromagneic theory, Lumped electromechanical elements, Circuit theory, Energy conversion, Riotating machines, Lumped-parameter electromechanical dynamics

MEN590 The Seminars [세미나]

The purpose of this course is to extend knowledge of the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

MEN690 Master's Research [석사논문연구]

This course is related to the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MEN732 Failure Analysis and Design for Reliability [파괴해석과 신뢰성 설계]

This course introduces various mathematical and experimental techniques employed for failure analysis, provides knowledge of fundamental physics of material and structure failure, and provide the knowledge needed to apply these concepts to design for reliability. Through term projects, students integrate fundamental principles and techniques.

MEN733 Mechanics of Polymer Solids and Fluids [고분자역학]

This course deals with continuum mechanics of solids and fluids, mechanics of deformation of anisotropic polymers, anisotropy and critical failures, such as yield, fracture and fatigue, non-Newtonian viscous and viscoelastic behavior of polymer fluids. Students will study the mechanics-based foundations for developing structure-property relations in polymer and learn constitutive models.

MEN734 Scanning Probe Microscopy [주사탐침현미경]

In variety of research areas, SPMs (scanning probe microscopes) work as a powerful research tool capable of providing spatially/temporally resolved diverse surface properties through the tip apex or micro/nanoelectrode integrated near/at the tip apex. This course provides fundamentals of diverse kinds of SPMs and applications of specific SPMs in details.

MEN755 Net Shape Manufacturing [소성가공]

This course focuses on the manufacturing of discrete parts to net or near net dimensions by stamping, forging, machining, and tube hydroforming.

MEN756 Laser Material Interaction and Processing II [레이저 재료 상호작용 및 가공 II]

In this course, students learn the basic principles of lasers and various interaction mechanisms in laser material interaction. Based on this basic knowledge, students will also learn various areas of laser materials processing. Topics include laser interaction with various materials (such as metals, semiconductors, dielectrics, and biological tissues), laser cutting, laser drilling, laser welding, laser heat treatment, laser cladding, and laser micromachining.

MEN772 Advanced Analytic Kinematics [해석기구학특론]

A machine is a combination of resistant bodies so arranged to transmit motion and forces. The device to transmit forces or modify motion is called a mechanism. The basic element of any machinery consists of various mechanisms, in the most cases of 2-D(dimensional) mechanisms. In this advanced lecture series, 3-D linkage mechanisms will be dealt with analytical methods. Understanding analyses methods of a mechanism is important procedure in designing a machine. And due to dynamic nature of the mechanism, the analysis or synthesis will be carried via computer, and it is known as one of the major application areas of CAD(Computer Aided Design). However, an analytical method, which produces the exact solution, belongs to the research domain. The Directional Cosine Matrix Method developed by the instructor will be discussed.

MEN773 Advanced Control Systems II [고급제어 II]

Stochastic State Estimation (Kalman filter), Linear Quadratic Gaussian Problem, Loop Transfer Recovery, Feedforward/preview control. Adaptive Control and Model Reference Adaptive Systems, Self Tuning Regulators, Repetitive Control, Analysis and synthesis techniques for multi-input (MIMO) control systems.

MEN791~797 Special Topics in Mechanical Engineering Ⅰ~Ⅶ [기계공학 특론Ⅰ~Ⅶ]

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.

MEN890 Doctoral Research [박사논문연구]

This course is related to the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Nuclear Engineering

Nuclear Engineering [NUE]

Department of Nuclear Engineering includes the advancement of safety measures in operating nuclear power plants, the development of fourth generation (Gen-IV) reactors including ultra-long cycle fast reactor (UCFR), small and medium-sized nuclear reactors. For these, the research is focused into nuclear fuel design (metallic fuel, coated fuel, ceramic fuel, and fuel cycle), reactor design including neutron transport and diffusion, and reactor core simulator, cladding and structural materials in advanced nuclear energy systems, design of advanced nuclear systems, nuclear safety systems and engineered features, advanced liquid metal transportation for fast reactors and nuclear fusion reactors, advanced nuclear radiation protection and detections, nanofluids and nanocomposites for advanced nuclear coolants and nuclear fuel. Furthermore, included are UniST Advanced Research Reactor (USTAR), avanced safety systems and molten core cooling systems for I-Power reactor, spent fuel storage, liquid metal MHD generation, accelerator physics, neutron science, nuclear data, and fundamentals of nuclear fusion for the future energy development.

Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

□ Curriculum ▶ Nuclear Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre-requisite	Convergence
Required	NUE590	Research	The Seminars	세미나	1-1-0		
Required	NUE690	Research	Master's Research	석사논문연구	Value of Credit		
Required	NUE600	Lecture	Research Trends in Nuclear Engineering I	원자력공학 연구 동향 I	3-3-0		
Required	NUE890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective (Ph.D.)	NUE719	Lecture	Special topics in Nuclear Engineering IV	원자력공학특론 IV	3-3-0		
Elective (Ph.D.)	NUE729	Lecture	Special topics in Nuclear Engineering V	원자력공학특론 V	3-3-0		
Elective	NUE619	Lecture	Special topics in Nuclear Engineering I	원자력공학특론 I	3-3-0		
Elective	NUE629	Lecture	Special topics in Nuclear Engineering II	원자력공학특론 II	3-3-0		
Elective	NUE639	Lecture	Special topics in Nuclear Engineering III	원자력공학특론 III	3-3-0		
Elective	NUE790	Research	Research Trends in Nuclaer Energy II	원자력공학 연구 동향 II	2-2-0		
Elective	NUE501	Lecture	Structural Mechanics in Energy Systems	에너지 시스템 구조 역학	3-3-0		O
Elective	NUE502	Lecture	Engineering of Nuclear Energy System	원자력 시스템 공학 특론	3-3-0		
Elective	NUE503	Lecture	Special Topics in Structural Materials in Energy Systems	에너지 구조 재료 공학 특론	3-3-0		
Elective	NUE504	Lecture	Advanced Energy Conversion	에너지 변환 공학 특론	3-3-0		
Elective	NUE505	Lecture	Modeling and Simulation in Energy System	에너지 전산 모사	3-3-0		
Elective	NUE507	Lecture	Nuclear Reactor Dynamics	원자로 동력학	3-3-0		
Elective	NUE510	Lecture	Nuclear Reactor Core Design and Engineering	원자로심설계공학	3-3-0		
Elective	NUE511	Lecture	Nuclear Fuel Engineering	핵연료 공학	3-3-0		
Elective	NUE512	Lecture	Radiation Measurement System I	방사선계측 I	3-3-0		
Elective	NUE513	Lecture	Nuclear Reactor Core Analysis I	원자로심해석 I	3-3-0		
Elective	NUE514	Lecture	Nuclear Reactor Core Analysis II	원자로심해석 II	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.–Lect.–Exp.	Pre-requisite	Convergence
Elective	NUE515	Lecture	Liquid Metal Magnetohydrodynamics I	액체금속 자기유체역학 I	3-3-0		
Elective	NUE516	Lecture	Nuclear Fuel Design and Peformance Analysis	핵연료설계 및 성능 분석	3-3-0		O
Elective	NUE517	Lecture	Nuclear Reactor Theory	원자로 이론	3-3-0		
Elective	NUE519	Lecture	Nuclear Safety	원자력 안전	3-3-0		
Elective	NUE520	Lecture	Nuclear Safety System Design and Lab	원전안전계통 설계실습	3-3-0		
Elective	NUE521	Lecture	Liquid Metal Magnetohydrodynamics II	액체금속 자기유체역학 II	3-3-0		
Elective	NUE522	Lecture	Special Topics on Advanced Nuclear Design Engineering	첨단 원자력 설계 공학 특론	3-3-0		O
Elective	NUE523	Lecture	Nuclear Safety and Convergence Technology	원자력 안전 및 융합 기술	3-3-0		O

□ Description

NUE590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

NUE690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

NUE600 Research Trends in Nuclear Engineering I [원자력공학 연구동향 I]

This course is designed to investigate recent trends in Nuclear energy fields and provide discussions with other students, researchers, and professors.

NUE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

NUE719 Special topics in Nuclear Engineering IV [원자력공학특론 IV]

This course covers the special field of nuclear engineering such as nuclear fuel cycle, radiation safety, radioactive waste, decontamination and dismantling which are not covered by the given courses. The content can be variable and will be chosen by the instructor.

NUE729 Special topics in Nuclear Engineering V [원자력공학특론 V]

This course covers the special field of nuclear engineering such as nuclear fuel cycle, radiation safety, radioactive waste, decontamination and dismantling which are not covered by the given courses. The content can be variable and will be chosen by the instructor.

NUE619 Special topics in Nuclear Engineering I [원자력공학특론 I]

This course covers the special field of nuclear engineering such as nuclear battery, nuclear propulsion and space applications which are not covered by the given courses. The content can be variable and will be chosen by the instructor.

NUE629 Special topics in Nuclear Engineering II [원자력공학특론 II]

This course covers the special field of nuclear engineering such as nuclear safety, probabilistic safety assessment and creative nuclear research reactor which are not covered by the given courses. The content can be variable and will be chosen by the instructor.

NUE639 Special topics in Nuclear Engineering III [원자력공학특론 III]

This course covers the special field of nuclear engineering such as nuclear safety, probabilistic safety assessment and creative nuclear research reactor which are not covered by the given courses. The content can be variable and will be chosen by the instructor.

NUE790 Research Trends in Nuclear Engineering II [원자력공학 연구동향 II]

This course is designed to investigate recent trends in Nuclear energy fields and provide discussions with other students, researchers, and professors. Through this course, the students will have opportunities to extend his/her knowledge in Nuclaer energy fields. Also students and professors can exchange their own ideas.

NUE501 Structural Mechanics in Energy Systems [에너지 시스템 구조 역학]

Structural components in energy systems, their functional purposes, operating conditions, and mechanical/structural design requirements. Combines mechanics techniques with models of material behavior to determine adequacy of component design. Considerations include mechanical loading, brittle fracture, inelastic behavior, elevated temperatures, neutron irradiation, vibrations and seismic effects.

NUE502 Engineering of Nuclear Energy System [원자력 시스템 공학 특론]

This course covers the advanced topics in engineering principles of nuclear reactors, emphasizing power reactors. Specific topics include power plant thermodynamics, reactor heat generation and removal (single-phase as well as two-phase coolant flow and heat transfer). It also discusses engineering considerations in reactor design.

NUE503 Special Topics in Structural Materials in Energy Systems [에너지 구조 재료 공학특론]

Applies thermodynamics and kinetics of electrode reactions to aqueous corrosion of metals and alloys. Application of advanced computational and modeling techniques to evaluation of materials selection and susceptibility of metal/alloy systems to environmental degradation in aqueous systems.

Discusses materials degradation problems in various energy system including nuclear.

NUE504 Advanced Energy Conversion [에너지 변환 공학 특론]

Introduces basic background, terminology, and fundamentals of energy conversion. Discusses current and emerging technologies for production of thermal, mechanical, and electrical energy. Topics include fossil and nuclear fuels, solar energy, wind turbines, fuel and solar cells.

NUE505 Modeling and Simulation in Energy System [에너지 전산 모사]

Concepts of computer modeling and simulation in materials science and engineering. Uses techniques and software for simulation, data analysis and visualization. Continuum, mesoscale, atomistic and quantum methods used to study fundamental and applied problems in physics, chemistry, materials science, mechanics, engineering, and biology. Examples drawn from the disciplines above are used to understand or characterize complex structures and materials, and complement experimental observations.

NUE507 Reactor Dynamics [원자로 동역학]

This course covers the time-dependent behaviour of nuclear reactors and the under-lying governing equations and their mathematical solutions. The delayed neutron, which makes nuclear reactor controllable, is investigated and derivation, validity, and solution of the point reactor equation are studied. Principles of the reactivity measurement and the reactivity feedback effects are also investigated. In addition, the general space-time-dependent reactor dynamics is studied.

NUE510 Nuclear Reactor Core Design and Engineering [원자로심설계공학]

The purpose of this course " Nuclear Reactor Core Design and Engineering" is to provide students with basic insight into nuclear reactor core design and engineering for use of nuclear energy as a safe and economical energy source. This course is designed to study nuclear fuel, nuclear design, thermal/hydraulic design, safety analysis, and nuclear fuel cycle economics. This course will also cover special topics such as reactor core design criteria, core design requirements, core design procedure, technical specifications, and nuclear power plant licensing.

NUE511 Nuclear Fuel Engineering [핵연료 공학]

This course covers the materials and structure, characteristics and basic in-reactor performance of the fuels used in PWR, BWR, CANDU, fast reactors, research reactor and small and medium size reactors. It will also introduce, for PWR UO_2 fuel, the basic requirements, fuel safety and design criteria, the basics of fuel rod design and fuel assembly design, important fuel performance modelling. It will also cover the basics of the design/analysis computer codes which are used in PWR UO_2 fuel design. Finally fuel fabrication processes of the PWR UO_2 fuel will be introduced.

NUE512 Radiation Measurement Systems [방사선 계측 I]

This course covers the principle of the radiation instruments. It deals with the counting and measurement mechanism for the ionizing radiation such as alpha, beta, gamma and neutron. It introduces radiation spectrometry, radioactivity analysis, calibration, measurement statistics including measurement uncertainty.

NUE513 Nuclear Reactor Core Analysis I [원자로심해석 I]

This class will study computational methods for nuclear engineering applications. Focus will be on the theory behind numerical methods for solving the partial differential equations encountered in nuclear reactor analysis. We will investigate various spatial discretization techniques, as well as the methods used to solve large, sparse systems of linear and nonlinear equations. Lectures will cover the various conservation laws for mass, energy, and momentum and the methods used to discretize the applicable elliptical and parabolic equations. Linear solution methods will include direct, iterative (e.g. SOR, etc.), and semi-iterative (e.g. Krylov, etc.) techniques, with special attention given to methods that lend themselves to high performance computing. Newton-Krylov methods will be introduced for solving nonlinear systems of equations.

NUE514 Nuclear Reactor Core Analysis II [원자로심해석 II]

This class will study computational methods for nuclear engineering applications. Focus will be on the theory behind numerical methods for solving the partial differential equations encountered in nuclear reactor analysis. We will investigate various spatial discretization techniques, as well as the methods used to solve large, sparse systems of linear and nonlinear equations. Lectures will cover the various conservation laws for mass, energy, and momentum and the methods used to discretize the applicable elliptical and parabolic equations. Linear solution methods will include direct, iterative (e.g. SOR, etc.), and semi-iterative (e.g. Krylov, etc.) techniques, with special attention given to methods that lend themselves to high performance computing. Newton-Krylov methods will be introduced for solving nonlinear systems of equations.

NUE515 Liquid Metal Magnetohydrodynamics I [액체금속 자기유체역학 I]

This course covers the magnetohydrodynamic (MHD) characteristic of the liquid metal used in fast reactor, nuclear fusion reactor and accelerator. Instructor will include Lorents' force produced in the liquid metal with the high electrical conductivity such as sodium, gallium, lead and mercury, flow characteristic, pressure drop under the magnetic field. The students will study the property of the electromagnetic pump for the liquid metal transportation and the liquid metal MHD electricity generation system.

NUE516 Nuclear Fuel Design and Performance Analysis [핵연료설계 및 성능 분석]

This course intends to provide the students with practical knowledge and experience for the design and analysis of the LWR UO_2 fuel. It will first discuss the backgrounds and the derivation of the fuel safety and design criteria, design and analysis method, and licensing requirements for LWR UO_2 fuel. The design models and actual measurement data on irradiation performances of the important in-reactor fuel performances, which includes fission gas release, densification and swelling, restructuring, fuel thermal conductivity change during irradiation, high burnup effects, cladding corrosion, cladding creep, pellet-cladding interaction, etc. will be discussed and compared. Practical examples of fuel rod design and fuel assembly design will be introduced and the practices with fuel design/analysis computer codes will be given.

NUE517 Nuclear Reactor Theory [원자로 이론]

The understanding of neutron behaviour in the nuclear reactor is very important for the design of new nuclear reactors and the safe operation of existing nuclear reactors. This course covers methodologies of neutron flux calculations, diffusion and slowing down theory, flux separation, material buckling, resonance absorption, Doppler effect, 2-group and multi-group theories, and reactivity balances for design and operation. There will be an introduction to reactor kinetics, delayed neutrons, point reactor kinetics, transient behavior, load changes, reactivity feedback, and safety implications.

NUE519 Nuclear Safety [원자력 안전]

The purpose of nuclear safety is to prevent the release of radioactive materials during events and accidents. This course covers the actions taken to prevent nuclear and radiation accidents or to limit their consequences. To date, there have been five serious accidents (core damage) in the world since 1970 (one at Three Mile Island in 1979; one at Chernobyl in 1986; and three at Fukushima-Daiichi in 2011), corresponding to the beginning of the operation of generation II reactors. Based on experiences of the accidents, the course discuss the safety culture as one relatively prevalent notion about nuclear safety.

NUE520 Nuclear Safety System Design and Lab [원전 안전 계통 설계실습]

This course covers the principles of design of the nuclear safety systems. The three primary objectives of nuclear reactor safety systems are to shut down the reactor, maintain it in a shutdown condition, and prevent the release of radioactive material during events and accidents. These objectives are accomplished using a variety of equipment, which is part of different systems, of which each performs specific functions. The students will participate in field-oriented design and practice programs.

NUE521 Liquid Metal Magnetohydrodynamics II [액체금속 자기유체역학 II]

This course is focused on the unbounded flow known as Rayleigh-Stokes flow, flow transition and magnetohydrodynamic (MHD) stability, which is characterized by a control parameter such as Reynolds or Rayleigh number and Hartman number, of the liquid metal flow in the externally-driven magnetic field. MHD turbulent flow is approached mathematically by using mean field theory and its local property is discussed for the different orientation of geometry, direction of magnetic field, and velocity. Also, the attention is focused on the solution of simple examples of magnetoconvective flows.

NUE522 Special Topics on Advanced Nuclear Design Engineering [첨단 원자력 설계 공학 특론]

This course will cover various aspects of nuclear reactor design: nuclear reactor core design including neutronics and thermal-hydraulics, spent fuel analysis, fuel cycle, and fast spectrum reactor system analysis as well as thermal system. Students will study the reactor design concepts and practice the design procedures using computer codes.

NUE523 Nuclear Safety and Convergence Technology [원자력 안전 및 융합 기술]

Safety feature of a nuclear reactor that does not require operator actions or electronic feedback in order to shut down safely in the event of a particular type of emergency (usually overheating resulting from a loss of coolant or loss of coolant flow) can be advanced using convergence technology, e.g. nuclear and nano-technologies and nuclear and ICT. After the Fukushima accidents, the multi-physics concepts based on thermal-hydraulics and materials sciences are becoming key factors to enhance nuclear safety. The area can be coupled by Information technology. The course will cover the multiphysics-based safety principles and introduce convergence technologies in recent trends.

Department of Materials Science Engineering

□ Materials Science Engineering [MSE]

The graduate department in Materials Science Engineering pursues the frontiers of modern materials science and engineering through education and research. We focus on various materials such as metals, ceramics, semiconductors, polymers and hybrid materials at both macroscopic and microscopic scale. Our mission in education is to help graduate students to seek solutions to current issues in MSE, so that eventually they can be creative leaders who can convert scientific ideas into changes in the real world. Our missions in research are to develop new materials and to generate new knowledge through theoretical and experimental investigation on them.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

□ Curriculum ▶ Materials Science Engineering [MSE]

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Required	MSE590	Research	The Seminars	세미나	1-1-0		
Required	MSE690	Research	Master's Research	석사논문연구	Value of credit		
Required	MSE890	Research	Doctoral Research	박사논문연구	Value of credit		
Elective	MSE501	Lecture	Advanced Thin Film Technology	박막공학특론	3-3-0		O
Elective	MSE502	Lecture	Nanoscale Surface Analysis	나노표면분석	3-3-0		
Elective	MSE505	Lecture	Advanced Thermodynmaics of Materials	고급열역학	3-3-0		
Elective	MSE511	Lecture	Nano Mechanics	나노역학	3-3-0		O
Elective	MSE512	Lecture	Advanced Ferrous Metals and Alloys	철강소재특론	3-3-0		
Elective	MSE531	Lecture	Light Emitting Diodes	LED공학개론	3-3-0		O
Elective	MSE550	Lecture	Semiconductor Physics and Devices	반도체 물성과 소자	3-3-0		
Elective	MSE551	Lecture	Surface and Interface Sciences	표면 및 계면과학	3-3-0		O
Elective	MSE552	Lecture	Characterization, Microstructure and Anisotropy of Materials	재료의 집합조직 및 이방성	3-3-0		
Elective	MSE553	Lecture	Electrochemical methods: fundamental science and applications	전기화학법: 기초과학 및 응용	3-3-0		O
Elective	MSE571	Lecture	Organic Optoelectric Materials and Devices	유기광전자재료 및 디바이스	3-3-0		
Elective	MSE572	Lecture	Carbon Nano Materials	탄소나노소재특론	3-3-0		
Elective	MSE580	Lecture	Polymer Structures and Properties	고분자구조 및 물성	3-3-0		
Elective	MSE601	Lecture	Synchrotron Radiation	방사광가속기 응용	3-3-0		
Elective	MSE611	Lecture	Advanced Light Metals and Alloys	경량금속소재특론	3-3-0		
Elective	MSE612	Lecture	Alloy Design	합금설계	3-3-0		
Elective	MSE631	Lecture	Electronic Properties of Materials	재료의 전자기적성질	3-3-0		
Elective	MSE711	Lecture	Advanced Metallic Materials	금속신소재특론	3-3-0		
Elective	MSE731	Lecture	Advanced Magnetic Materials	자성재료특론	3-3-0		
Elective	MSE732	Lecture	Advanced Electric Ceramics	전자세라믹스특론	3-3-0		
Elective	MSE753	Lecture	Nano Convergent Energy Devices	나노융합에너지소자	3-3-0		
Elective	MSE754	Lecture	Advanced Semiconductor Devices	고급반도체소자론	3-3-0		
Elective	MSE771	Lecture	Special Topics on flexible Electronic Materials	플렉시블 전자소재특론	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	MSE801	Lecture	Special Topics on Materials Science Engineering Ⅰ	신소재공학특론 Ⅰ	3-3-0		
Elective	MSE802	Lecture	Special Topics on Materials Science Engineering Ⅱ	신소재공학특론 Ⅱ	3-3-0		
Elective	MSE803	Lecture	Special Topics on Materials Science Engineering Ⅲ	신소재공학특론 Ⅲ	3-3-0		
Elective	MSE804	Lecture	Special Topics on Materials Science Engineering Ⅳ	신소재공학특론 Ⅳ	3-3-0		
Elective	MSE805	Lecture	Special Topics on Materials Science Engineering Ⅴ	신소재공학특론 Ⅴ	3-3-0		
Elective	MSE806	Lecture	Special Topics on Materials Science Engineering Ⅵ	신소재공학특론 Ⅵ	3-3-0		
Elective	MSE807	Lecture	Special Topics on Materials Science Engineering Ⅶ	신소재공학특론 Ⅶ	3-3-0		
Elective	MSE808	Lecture	Special Topics on Materials Science Engineering Ⅷ	신소재공학특론 Ⅷ	3-3-0		
Elective	MSE809	Lecture	Advanced Semiconductor Devices	고급반도체소자론	3-3-0		
Elective	MSE851	Lecture	Advanced Transmission Electron Microscopy	전자현미경학특론	3-3-0		
Elective	MSE852	Lecture	Quantum Analysis and Modeling	양자해석 및 설계	3-3-0		

※ Undergraduate Senior can register courses : "MSE511 Nano Mechanics", "MSE550 Semiconductor Physics and Devices", "MSE551 Surface and Interface Sciences", "MSE571 Organic Optoelectric Materials and Devices", "MSE572 Carbon Nano Materials", "MSE611 Advanced Light Metals and Alloys"

□ Description

MSE501 Advanced Thin Film Technology [박막공학특론]

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.

MSE502 Nanoscale Surface Analysis [나노표면분석]

This course provides the fundamental principles of scanning tunneling microscopy (STM), scanning tunneling spectroscopy (STS), and related technique. The topic will also cover the application of STM and recent STM works on th nanoscale materials systems.

MSE505 Advanced Thermodynamics of Materials [고급열역학]

This course is focused on the understanding of material properties and fundamental phenomena related to material processes. It covers phase equilibrium, calculation of heat capacitance, and the relation between free energy and phase diagram, etc.

MSE511 Nano Mechanics [나노역학]

This course covers mechanical behavior of materials at the nano-scale. While mechanical properties of materials have been known to be independent of size at the bulk-scale, mechanical behavior of materials at the nano-scale strongly depends on size. This course covers synthesis and characterization methods of nano-materials, and experimental approaches to measure and analyze mechanical behavior of materials at the nano-scale.

MSE512 Advanced Ferrous Metals and Alloys [철강소재특론]

This course aims to understand the microstructure and mechanical properties of ferrous metals and alloys, which are being used in a variety of industrial fields. The phase transformation phenomena we will cover in this course include TRIP and martensitic transformations. The relationship between microstructure and deformation behavior in the ferrous materials will also be discussed.

MSE531 Light Emitting Diodes [LED공학개론]

Technical progress in the field of light-emitting diodes has been breathtaking during the last few decades. State-of-the art LEDs are small, rugged, reliable, bright, and efficient. In contrast to many other light sources, LEDs have the potential of converting electricity to light with near-unity efficiency. This course will review the electrical and optical fundamentals of LEDs as well as advanced device structures. Recent technological breakthroughs and several application areas of LEDs including illumination and communication will also be discussed.

MSE550 Semiconductor Physics and Devices [반도체 물성과 소자]

This course is designed to provide professional understanding in the current (and future) device physics. The basics of semiconductor devices will be reviewed and the detailed phenomenological study on transistor, metal-semiconductor contact, PN junction, MOS capacitor, and JFET etc. will be offered.

MSE551 Surface and Interface Sciences [표면 및 계면과학]

This course concentrates on the surface property of solid matter, especially on metals and semiconductors. Various materials properties, such as physical, chemical, electrical and mechanical properties depend on the surface phase and its treatment. These novel properties of surfaces can be used to develop structural and functional materials.

MSE552 Characterization, Microstructure and Anisotropy of Materials [재료의 집합조직 및 이방성]

The purpose of this course is to mainly acquaint the student with texture, microstructure and anisotropy of aggregates of crystalline solids, i.e., polycrystals. The specific areas of learning include the mathematical basis for crystallographic (preferred) orientation (pole figures, inverse pole figures, ODF, and etc), grain boundary anisotropy (interface texture by misorientation distribution and grain boundary character/energy distributions), texture measuring methods (EBSD and X-ray), the effect of texture on elastic and plastic anisotropy in polycrystals, and image analysis and extraction of 3D information.

MSE553 Electrochemical methods: fundamental science and applications [전기화학법: 기초과학 및 응용]

The fields of electrochemistry and electroanalytical chemistry have evolved substantially in this few decades. The understanding of the fundamental sciences played crucial roles in wide electrochemical research and advanced technology development. This course is designed to provide fundamental electrochemistry and introduce various electrochemical processes and methods. Basic principles of physics and chemistry, overview of electrode processes, thermodynamics, charge transfers and interfacial reactions will be covered and discussed.

MSE571 Organic Optoelectric Materials and Devices [유기광전자재료 및 디바이스]

This course will provide the characteristics of electro-optic organic materials, such as conjugated polymers, liquid crystals, and devices will be reviewed and discussed. Their applications for organic optoelectronics such as organic LEDs, solar cells and laser diodes will be explained.

MSE572 Carbon Nano Materials [탄소나노소재특론]

This course will deal with the thermal, mechanical, physical, electronic, chemical properties of carbon nano materials such as fullerene, nanotube, graphene and so on. The related applications and analysis of carbon allotropes will also be covered.

MSE580 Polymer Structures and Properties [고분자구조 및 물성]

This course presents the physical properties of polymers, such as the chain confirmation, fluctuation, entanglements, etc. The macroscopic properties of polymeric materials are dramatically influenced by these changes in their microscopic state. Macromolecules beyond the simple polymers such as membranes, gels, polyelectrolytes and biopolymers and the formation of block copolymer nanostructures will also be studied.

MSE590 The Seminars [세미나]

The purpose of this course is to extend knowledge of the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

MSE601 Synchrotron Radiation [방사광가속기 응용]

This course is intended to provide an introduction to the physics and applications of synchrotron radiation. The relevant basic principles such as radiation, scattering, wave propagation, diffraction, and coherence will be reviewed and a broad range of phenomena and applications of synchrotron radiation including soft x-ray microscopy, spectromicroscopy, and soft x-ray laser will be covered.

MSE611 Advanced Light Metals and Alloys [경량금속소재특론]

This course aims to understand the microstructure and mechanical properties of light metals and alloys, which include aluminum, magnesium, titanium, and their alloys. Solidification, recrystallization, and precipitation phenomena will be covered in this course. The relationship between microstructure and deformation behavior in the non-ferrous materials will also be discussed.

MSE612 Alloy Design [합금설계]

This class will cover the theoretical fundamentals of metallic alloy design, utilization methods of thermodynamic database and commercial softwares, alloy fabrication, and characterization of the microstructure and mechanical properties of designed alloys.

MSE631 Electronic Properties of Materials [재료의 전자기적성질]

This class discusses the origin of electrical, magnetic and optical properties of materials, with a focus on the acquisition of quantum mechanical tools. It begins with an analysis of the properties of materials, presentation of the postulates of quantum mechanics, and close examination of the hydrogen atom, simple molecules and bonds. The course continues with the free electron model, elemental kinetic theory of thermal and electrical transport, band theory, and semiconductor physics and its applications.

MSE690 Master's Research [석사논문연구]

This course is related to the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MSE711 Advanced Metallic Materials [금속신소재특론]

This course deals with metallic materials widely studied recently in materials science and engineering and further expands to the understanding of relationships of processing, properties and mechanisms. While conventional metallic materials focus on structural materials at bulk scale, more discussion is placed on various metallic materials at multi-scales with various applications.

MSE731 Advanced Magnetic Materials [자성재료특론]

The study of magnetism and its intricacy with electricity runs in parallel with the technological drive to find new functional materials and their applications to the electronics, such as spintronics. This course aims to provide review on microscopic and macroscopic properties of magnetic materials and the subjects of intense research activities in magnetism. Topics include isolated magnetic moments, environmental effects, their mutual interactions which lead to phase transitions, Further discussion on order and broken symmetry will be provided. The class will also review intense modern research areas, such as spintronics and nanomagnetism.

MSE732 Advanced Electric Ceramics [전자세라믹스특론]

This course will offer the basic understanding on dielectric properties of current transport mechanisms in thin insulating films which is (or will be) used in semiconductor memory and logic devices. The basics of memory devices will be reviewed and the detailed phenomenological study on the dielectric properties and leakage current properties of high-dielectric thin film will be offered.

MSE753 Nano Convergent Energy Devices [나노융합에너지소자특론]

This course provides the fundamental understandings of optoelectronic properties of nanomaterial. The energy related topics of nanomaterials such as LED, fuel cell, solar cell will be discussed in this lecture.

MSE754 Advanced Semiconductor Devices [고급반도체소자론]

This class will cover basic operation principles of Si or compound semiconductor devices including field-effect transistor, light-emitting diode, laser diode, solar cell, and nanoelectronics. Especially, this class will help graduate students grasp state-of-the-art research trends through case study and invited talks on specific semiconductor devices.

MSE771 Special Topics on Flexible Electronic Materials [플렉시블 전자소재특론]

Low cost roll-to-roll manufacturing process for flexible electronics and other applications are increasingly drawing attention as emerging technology platform for device fabrication. This course covers fundamental understanding of flexible conductive and semiconductor materials and their device applications to organic light-emitting devices, organic solar cells and organic thin film transistors. Further discussion on deposition processes, interfacial engineering and functional coatings will be discussed. The course will also go over the patterning techniques such as embossing and self-aligned imprint lithography, transfer technologies, digital fabrication, and printed electronics.

MSE801 Special Topics on Materials Science Engineering Ⅰ [신소재공학특론 Ⅰ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on advanced structural materials, multifunctional metallic composites, characterizations of materials at the nano-scale. This content is changeable depending on instructor.

MSE802 Special Topics on Materials Science Engineering Ⅱ [신소재공학특론 Ⅱ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on polymer nanocomposites, electronics, spintronics, and organic/inorganic optical materials. This content is changeable depending on instructor.

MSE803 Special Topics on Materials Science Engineering Ⅲ [신소재공학특론Ⅲ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

MSE804 Special Topics on Materials Science Engineering Ⅳ [신소재공학특론 Ⅳ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

MSE805 Special Topics on Materials Science Engineering Ⅴ [신소재공학특론 Ⅴ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

MSE806 Special Topics on Materials Science Engineering Ⅵ [신소재공학특론 Ⅵ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

MSE807 Special Topics on Materials Science Engineering Ⅶ [신소재공학특론 Ⅶ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

MSE808 Special Topics on Materials Science Engineering Ⅷ [신소재공학특론 Ⅷ]

This course covers cutting-edge technologies with applications in materials science and engineering, especially on graphene, low-dimensional crystals, optoelectronic materials, and nano devices. This content is changeable depending on instructor.

MSE809 Advanced Semiconductor Devices [고급반도체소자론]

This class will cover basic operation principles of Si and compound semiconductor devices including field-effect transistor, light-emitting diode, laser diode, solar cell, and nanoelectronics. Especially, this class will help graduate students grasp state-of-the-art research trends through case study and invited talks on specific semiconductor devices.

MSE851 Advanced Transmission Electron Microscopy [전자현미경특론]

The need for micro- and nano-structure characterizations is now increasing as both the structural and electronic materials become smaller and smaller. In this course we study the advanced principles and techniques for modern transmission electron microscopy including 1) Imaging theory and experiments in high resolution electron microscopy, 2) Nano-diffraction and convergent beam electron diffraction, 3) X-ray energy dispersive spectroscopy, 4) electron energy loss spectroscopy and 5) simulations etc. Details of this lecture may be modified later.

MSE852 Quantum Analysis and Modeling [양자해석 및 설계]

In this course, we will discuss quantum calculation methods such as DFT and HF. To understand the characteristics of nanomaterials using quantum simulations, the theoretical backgrounds and the basic concept of algorithm will be introduced. Some basic explanation of quantum physics and solid-state physics will be briefly introduced for engineers who are not familiar with quantum mechanics

MSE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Biomedical Engineering

□ Biomedical Engineering[BME]

The graduate program of biomedical engineering offers multidisciplinary research and education at the intersection of engineering, medicine, and the biological sciences to improve health and quality of life and to solve global crises related to energy and the environment. Research in the graduate program of biomedical engineering focuses on the application of engineering principles to design and manipulate biological systems as well as to analyze and understand biological phenomena contributing to the leading-edge technologies. This graduate program also offers a number of pertinent courses providing the students with the know-how and practical experience needed, through in-depth discussions and laboratory experiments. Education in the biomedical engineering graduate program leads the students to become leading researchers and experts within their area as well as creative leaders for both academia and industry.

□ Credit Requirement

Program	Total Credits	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's –Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Biomedical Engineering[BME]

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
Required	BME690	Research	Master's Research	석사논문연구	Value of Credit		
	BME890	Research	Dortoral Research	박사논문연구	Value of Credit		
Elective	BME590	Research	Seminar	세미나	1-1-0		
	BIO501	Lecture	Advanced Biochemistry	고급생화학	3-3-0		Core Subject
	BIO502	Lecture	Advanced Molecular Biology	고급분자생물학	3-3-0		Core Subject
	BIO503	Lecture	Advanced Cell Biology	고급세포생물학	3-3-0		Core Subject
	BME501	Lecture	Biology and Micro/Nanotechnology	생물학과 마이크로/나노공학	3-3-0	O	Core Subject
	BME502	Lecture	Advanced Biomedical Engineering	고급생명공학	3-3-0		Core Subject
	BME503	Lecture	Advanced Spectroscopy and Imaging	첨단분광학및영상학	3-3-0	O	Core Subject
	BME505	Lecture	Advanced Bioanalysis	고급바이오분석	3-3-0		Core Subject
	BME508	Lecture	Engineering Physiology	공학생리학	3-3-0		Core Subject
	BME510	Lecture	Quantitative Systems Biology	정량적시스템생물학	3-3-0		Core Subject
	CHM582	Lecture	Advanced Nanoscience and Nanotechnology	고급나노과학기술	3-3-0	O	
	BME504	Lecture	Design and Analysis of Experiments	실험계획및분석	3-3-0		
	BME506	Lecture	Special Topics on Biomimetic Engineering	생체모사공학특강	3-3-0	O	
	BME507	Lecture	BioMEMS	바이오멤스	3-3-0	O	*
	BME509	Lecture	Introduction to Biomedical Optics	의광학개론	3-3-0	O	*
	BME601	Lecture	Essential Biology for Engineers	공학도를 위한 생물학	3-3-0	O	
	BME602	Lecture	Micro and Nanofabrication	세포신호전달학	3-3-0		
	BME603	Lecture	Special Topics in Metabolic Engineering	대사공학특론	3-3-0	O	
	BME604	Lecture	Advanced Topics in Computational Neuroscience	계산신경과학특론	3-3-0	O	
	BME605	Lecture	Quantitative Analysis for Biomedical Images	의생명영상의 정량적분석	3-3-0	O	

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
Elective	BIO607	Lecture	Advanced Microbial Physiology	고급미생물생리학	3-3-0		
	BME607	Lecture	Current Topics of Synthetic Biology	합성생물학특론	3-3-0		
	BME608	Lecture	Lasers in Biomedical Engineering	레이저와 의생명공학	3-3-0	O	
	BME609	Lecture	Advanced Fluorescence Microscopy	고급형광현미경	3-3-0	O	
	BME700	Lecture	Technical Writing in English	영어논문작성법	3-3-0		
	BME701	Lecture	Biorefinery	바이오리파이너리	3-3-0		
	BME703	Lecture	Current Topics in Bioenergy and Biotechnology	바이오 테크놀로지특론	3-3-0		
	BME704	Lecture	Spatial Aspects of Magnetic Resonance	공간자기공명학	3-3-0		
	BME705	Lecture	Control of Biomolecules	생리분자제어	3-3-0		
	BME706	Lecture	Frontiers of Biomedical Engineering	최신의생명공학특론	3-3-0		
	BME707	Lecture	Inventions and Patents	발명과특허	3-3-0		
	BME801	Lecture	Special Lectures in Biomedical Engineering A	최신생명공학특론A	3-3-0		
	BME802	Lecture	Special Lectures in Biomedical Engineering B	최신생명공학특론B	3-3-0		
	BME803	Lecture	Special Lectures in Biomedical Engineering C	최신생명공학특론C	3-3-0		
	BME804	Lecture	Special Lectures in Biomedical Engineering D	최신생명공학특론D	3-3-0		
	BME805	Lecture	Special Lectures in Biomedical Engineering E	최신생명공학특론E	3-3-0		
	BME806	Lecture	Special Lectures in Biomedical Engineering F	최신생명공학특론F	3-3-0		
	BME807	Lecture	Special Lectures in Biomedical Engineering G	최신생명공학특론G	3-3-0		
	BME808	Lecture	Special Lectures in Biomedical Engineering H	최신생명공학특론H	3-3-0		
Elective	BME809	Lecture	Special Lectures in Biomedical Engineering I	최신생명공학특론I	3-3-0		
	BME810	Lecture	Special Lectures in Biomedical Engineering J	최신생명공학특론J	3-3-0		

※ The courses marked with "*" are open also for the seniors in undergraduate program.
※ Student in combined master's-doctoral program and doctoral program must obtain grade A from at least 2 courses from Core Subjects

□ Description

BIO501 Advanced Biochemistry

This is an intensive course in Biochemistry. Beside lectures, graduate students will also be trained to criticize and interpret experimental data on various biochemistry topics by presenting recent research papers published in top-quality journals.

BIO502 Advanced Molecular Biology

This course will cover the molecular biological aspects of a variety of biological phenomena, such as genetic structure and regulation of gene expression in prokaryotic and eukaryotic organisms; mechanisms of gene action and gene/enzyme relationships; biochemical manipulation and characterization of genetic macromolecules. A series of presentations and discussions on recent research achievements in molecular biology will equip graduate students with up-to-date knowledge and techniques in the field of advanced molecular biology, which will improve their performance as an independent researcher.

BIO503 Advanced Cell Biology

This is an intensive course of Cell Biology. In addition to lectures, graduate students will also be trained to criticize and interpret experimental data on various cell biology topics including up-to-date research achievements on cancer biology as well as the stem cell field.

BME501 Biology and Micro/Nanotechnology

This course will review fabrication techniques (e.g. micropatterning of surfaces, soft lithography, BioMEMS) and examples of microfluidic chemical analytical systems through lectures and discussion of current literature. Students will learn how to make a device and operate it, how to do group discussions (oral presentation) and how to do a critical review (writing).

BME502 Advanced Biomedical Engineering

In general, advanced bioengineering can be defined as the application of engineering concepts and tools to the broad field of biomedical and biochemical engineering. The course covers the basic application of biology and biochemistry to tissue engineering, bioMEMS, bioimaging technology, fermentation engineering, metabolic engineering, and systems biotechnology.

BME503 Advanced Spectroscopy and Imaging

A series of lectures provides basic principles of molecular spectroscopy and biomedical imaging methods. Emphasis is laid on infrared (IR) spectroscopy and nuclear magnetic resonance (NMR) spectroscopy and imaging. Topics include FT-IR, 2DIR, FT-NMR, 2D-NMR, MRI, and other frequently used spectroscopic techniques such as pump-probe spectroscopy and flourescence resonance energy transfer (FRET).

BME505 Advanced Bioanalysis

The goals of this class are 1) basic introduction to DNA, RNA and protein structure, 2) methods for the elucidation of biopolymer structure including PCR, sequencing, electrophoresis, DNA microarrays, cDNA microarrays, protein microarrays, expression analysis, fluorescence spectroscopy and electrochemical techniques, and 3) implementation of conventional bench-top tooLS for biomolecular analysis followed by a comparison to micro-scale and nano-scale tools for molecular analysis. In particular, scaling factors will be evaluated when transitioning molecular analysis tools to micro- and nano-scale processing.

BME508 Engineering Physiology

This is introductory course designed for graduate Biomedical Engineering students. This course mainly covers how to apply knowledge of mathematics and engineering to human physiology. Initial lectures will focus on the review of human anatomy and physiology. Subsequently, the role of fundamental physiological principles will be illustrated in specific organ systems through more detailed discussions of the muscular, nervous, sensory, cardiovascular and respiratory systems. At last, these concepts will be quantitatively analyzed by engineering model and simulation. In order to follow the course contents, students should be comfortable with the use ordinary differential equations and linear system analysis.

BME510 Quantitative Systems Biology

This course outlines the systemic approach in which the life phenomena are viewed as an information processing and a material-energy transport at a cellular level. We review, on a firmly quantitative and molecular basis, the DNA replication, Central Dogma, and regulatory mechanisms that a cell utilises to cope with the constantly changing environment. The course aims to provide the conceptual tools for scientists and engineers, particularly working in the fields of interdisciplinary bioscience and biotechnology. Throughout the course, theoreticians will be guided to critically appreciate current experimental methods and experimentalists to discriminate the quality of modelling or computational studies. The target audience includes graduates and higher undergraduates with the training background in biology or in physics, engineering, computer science.

CHM582 Advanced Nanoscience and Nanotechnology

This course presents a review of recent scientific papers in modern nanoscience and nanotechnology, and introduces principles of sciences and technologies appearing in the review. This course deals with advanced subjects.

BME504 Design and Analysis of Experiments

Various tools for design of experiments and statistical data analysis methods including 6 sigma in R&D, technical roadmap, QFD, technical tree, process mapping, MSA, DOE are discussed. Students can practice them by applying the techniques to case studies or their own projects.

BME506 Special Topics on Biomimetic Engineering

Biomimetics is a biologically inspired technology that mimics the structures and functions of biological systems. This course introduces students to the technology and gives a review of selected topics of biomimetics such as bioinspired self-assembly, biomimetic surfaces, and biomimetic nanosystems.

BME507 BioMEMS

This course introduces BioMEMS, one of the most common interdisciplinary research areas, and will initially cover the physical principles of micro-structure and micro-fabrication techniques. The latter part of the class will cover case studies of design, fabrication, and the application of diverse micro/nano-devices, including micro/nano-mechanical sensors (accelerometer, pressure sensor, flow sensor, temperature sensor), micro-actuators, and microfluidics.

BME509 Introduction to Biomedical Optics

This course aims to introduce fundamentals and frontier topics of biomedical optics to mainly graduate students as well as high-level undergraduate students. The course covers an overview of fundamental optics, light-matters interactions, and the principle of optical sensors and imaging systems. This course will also provide an overview of emerging technologies and research trends in biomedical optics for solving current challenges in biology and medicine.

BME602 Micro and Nanofabrication

MEMS/NEMS technologies are adopted in a variety of mechanical, electronic devices and bio-sensors. This course introduces basic principles of conventional microfabrication techniques for MEMS device fabrication and includes their applications and some case studies. MEMS is a typical interdisciplinary research area so that the application of this course is expected to be extended to the research areas such as electronic engineering, biochemistry, chemistry, physics, medical science and etc.

BME603 Special Topics in Metabolic Engineering

Starting from Central Dogma, we will take quantitative approach to the regulation of gene expression in natural and engineered genetic circuits, which will be integrated into the control of cellular growth and metabolism. Both theory and experiment majors from either biochemical engineering or physical sciences are welcome. Working knowledge of thermodynamics and/or physical chemistry and a basic command of introductory molecular biology is desirable but not essential.

BME604 Advanced Topics in Computational Neuroscience

This course provides an analytical framework and numerical methods for neuroscience. We will take hierarchical approaches, starting from membrane biophysics and extending to the neuronal and supra-neuronal scale information processing. Various phenomenological models based on Nernst, Goldman, Hodgkin-Huxley and Fitzhugh-Nagumo equations will be reviewed, and recent achievements will be discussed.

BME605 Quantitative Analysis for Biomedical Images

Fundamental image signal processing with particular emphasis on problems in biomedical research and clinical medicine. Emphasis on quantitative image handling of MRI, PET and optical image data. Topic will include data acquisition, imaging, filtering, feature extraction, pattern recognition and modeling.

BIO607 Advanced Microbial Physiology

This class will look into the inner workings of microbial growth and metabolism. Emphasis will be given to the study of transport systems, metabolic balances (redox/mass/energy), metabolic flux analysis, genetic regulation and the effects of environmental stimuli on the gene expression patterns, with a general focus on bioproduction and whole-cell biosensor systems.

BME607 Current Topics of Synthetic Biology

A series of presentations and discussions on recent research achievements in synthetic biology will equip graduate students with up-to-date knowledge and techniques in the field of Synthetic Biology, which will improve their performance as an independent researchers.

BME608 Lasers in Biomedical Engineering

The objective of this course is to provide fundamentals and frontier topics of laser applications in biomedical field. This course will cover the basic principles of laser and laser-tissue interaction and furthermore discuss practical applications in various clinical environments.

BME609 Advanced Fluorescence Microscopy

A series of lectures provides basic principles of fluroescence spectroscopy and the most advanced fluorescence microscopic methods. Emphasis is laid on single molecule fluorescence microscopy and super-resolution fluorescence microscopy. Topics include FRET, FIONA, STORM, STED, SIM, and many other fluorescence imaging methods relevant in biological applications.

BME700 Technical Writing in English

This course is designed to improve English writing skills for graduate students. It provides opportunity to do critical review of research articles as well as to practice technical writing in English. Students write a review article or their own research papers throughout the course.

BME701 Biorefinery

This course provides a detailed overview of different biorefinery concepts and deals with how different types of biomass resources can serve as feedstock for the production of biofuels, chemicals, and raw materials.

BME703 Current Topics in Bioenergy and Biotechnology

This course will review current research and publications related to bioenergy and biotechnology and the issues/goals being addressed. Students are required to participate within in-depth discussions about the topics and how it applies to their own research goals.

BME704 Spatial Aspects of Magnetic Resonance

This course provides detailed classical and quantum description of NMR theory. Emphasis is on spatial aspects of magnetic resonance, including discussions of basic image reconstruction, image contrast, diffusion and flow measurements, and hardware design considerations. Exposure to laboratory NMR spectroscopic and imaging equipment is included.

BME705 Control of Biomolecules

The goal of this course is to understand the relationship between the structure and function of biomolecules and to develop solid knowledge of current research and technical development. In addition, this course covers biological regulations by the modifications of protein such as phosphorylation, glycosylation, methylation and proteolytic activation.

BME706 Frontiers of Biomedical Engineering

This course discusses recent research trends in biomedical engineering, specifically, 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.

BME707 Inventions and Patents

Students can learn how to think creatively and how to make inventions. Students can practice creative thinking, claim analysis, and writing patent specifications by using case studies or their own projects.

BME801-810 Special Lectures in Biomedical Engineering A-J

This course is designed to introduce the current trends and the state-of the-art states of new biomedical diagnostics and therapeutics, green energy, and bioremediation. To keep the flexibility of the course, the topics and the instructors will be changed every semesters.

BME590 The Seminars

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

BME690 Master's Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

BME890 Doctoral Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Biological Sciences

□ Biological Sciences [BIO]

The graduate department of Biological Sciences offers interdisciplinary research training based on fundamental understandings on living organisms and applied knowledge to medical science in order to improve quality of life. The department provides a world-class research environment for biological and medical sciences, such as a state-of-art animal research center, Olympus biomed imaging center, stem cell research center, and cancer research center. This department aims to produce young, brilliant, and creative scientific minds, with world-class renown, by educating them so they are fully equipped and familiar with the basic knowledge of biological and medical sciences as well as cutting-edge research technologies in the state-of-the-art facilities provided by UNIST.

□ Credit Requirement

Program	Total Credits	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's -Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Biological Sciences

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.–Lect.–Exp.	Convergence	Remark
Required	BIO690	Research	Master's Research	석사논문연구	Value of Credit		
	BIO890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective	BIO590	Research	Seminar	세미나	1-1-0		
	BIO501	Lecture	Advanced Biochemistry	고급생화학	3-3-0		Core Subject
	BIO502	Lecture	Advanced Molecular Biology	고급분자생물학	3-3-0		Core Subject
	BIO503	Lecture	Advanced Cell Biology	고급세포생물학	3-3-0		Core Subject
	BIO504	Lecture	Stem Cell Engineering	줄기세포공학	3-3-0	O	*
	BIO505	Lecture	Cancer Biology	암생물학	3-3-0		*
	BIO506	Lecture	Biochemistry of Diseases	질환생화학	3-3-0		*
	BIO507	Lecture	Biomolecular Network	생분자네트워크	3-3-0		*
	BIO508	Lecture	Structural Biology	구조생물학	3-3-0	O	*
	BIO509	Lecture	Protein Engineering	단백질공학	3-3-0	O	
	BIO601	Lecture	Protein Crystallography	단백질결정학	3-3-0	O	
	BIO602	Lecture	Signal Transduction in Cells	세포신호전달학	3-3-0		
	BIO603	Lecture	Current topics in Immunology I	면역학특론 I	3-3-0		
	BIO604	Lecture	Neurobiology	신경생물학	3-3-0		
	BIO605	Lecture	Biomaterial and Nanobiotechnology	생체재료와 나노바이오테크놀로지	3-3-0	O	
	BIO606	Lecture	Analytical Chemistry of Biomolecules	생물분자분석특론	3-3-0	O	
	BIO607	Lecture	Advanced Microbial Physiology	고급미생물생리학	3-3-0		
	BIO608	Lecture	Advanced Endocrinology and Metabolism	고급 내분비 및 대사학	3-3-0		
	BIO701	Lecture	Molecular Physiology	분자생리학	3-3-0		
	BIO702	Lecture	Current Topics in Immunology II	면역학특론 II	3-3-0		
	BIO703	Lecture	Topics in Genome Data Analysis	유전체데이터분석특론	3-3-0	O	
	BIO704	Lecture	Current Topics of Biomedical Research	의생명과학특론	3-3-0		
	BIO705	Lecture	Mitochondria Biology	미토콘드리아생물학	3-3-0		
	BIO706	Lecture	Statistical Genetics	통계유전학	3-3-0	O	

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
Elective	BIO707	Lecture	Advanced Structural Biology	구조생물학특론	3-3-0		
	BIO708	Lecture	Current Topics in Protein Engineering	최신단백질공학특론	3-3-0		
	BIO709	Lecture	Current Topics in Cellular Physiology	최신세포생리학특론	3-3-0		
	BIO710	Lecture	Current Topics in Developmental Biology	최신발생생물학특론	3-3-0		
	BIO711	Lecture	Current Topics in Molecular Medicine	최신분자의학특론	3-3-0		
	BIO712	Lecture	Current Topics in Stem Cell Biology	최신줄기세포공학특론	3-3-0		
	BIO713	Lecture	Patho-biotechnology	병리-바이오테크놀로지	3-3-0	O	
	BIO801	Lecture	Special Lectures in Biological Sciences A	최신생명과학특론A	3-3-0		
	BIO802	Lecture	Special Lectures in Biological Sciences B	최신생명과학특론B	3-3-0		
	BIO803	Lecture	Special Lectures in Biological Sciences C	최신생명과학특론C	3-3-0		
	BIO804	Lecture	Special Lectures in Biological Sciences D	최신생명과학특론D	3-3-0		
	BIO805	Lecture	Special Lectures in Biological Sciences E	최신생명과학특론E	3-3-0		
	BIO806	Lecture	Special Lectures in Biological Sciences F	최신생명과학특론F	3-3-0		
	BIO807	Lecture	Special Lectures in Biological Sciences G	최신생명과학특론G	3-3-0		
	BIO808	Lecture	Special Lectures in Biological Sciences H	최신생명과학특론H	3-3-0		
	BIO809	Lecture	Special Lectures in Biological Sciences I	최신생명과학특론I	3-3-0		
	BIO810	Lecture	Special Lectures in Biological Sciences J	최신생명과학특론J	3-3-0		

※ The courses marked with "*" are open also for the seniors in undergraduate program.
※ Student in combined master's-doctoral program and doctoral program must obtain grade A from at least 2 courses from Core Subjects

□ Course Description

BIO501 Advanced Biochemistry

This is an intensive course in Biochemistry. Beside lectures, graduate students will also be trained to criticize and interpret experimental data on various biochemistry topics by presenting recent research papers published in top-quality journals.

BIO502 Advanced Molecular Biology

This course will cover the molecular biological aspects of a variety of biological phenomena, such as genetic structure and regulation of gene expression in prokaryotic and eukaryotic organisms; mechanisms of gene action and gene/enzyme relationships; biochemical manipulation and characterization of genetic macromolecules. A series of presentations and discussions on recent research achievements in molecular biology will equip graduate students with up-to-date knowledge and techniques in the field of advanced molecular biology, which will improve their performance as an independent researcher.

BIO503 Advanced Cell Biology

This is an intensive course of Cell Biology. In addition to lectures, graduate students will also be trained to criticize and interpret experimental data on various cell biology topics including up-to-date research achievements on cancer biology as well as the stem cell field.

BIO504 Stem Cell Engineering

Stem cells have the remarkable potential to develop into many different cell types in the body during early life and growth. Given their unique regenerative abilities, stem cells offer new potentials for treating diseases such as diabetes, neural and heart disease. Research on stem cells continues to advance knowledge about how an organism develops from a single cell and how healthy cells replace damaged cells in adult organisms. Stem cell research is one of the most fascinating areas of contemporary biology. One of UNIST’s core research programs is Stem Cell Research. The class in this core program is focused on understanding the pluripotency of mouse and human embryonic stem cells.

BIO505 Cancer Biology

This course provides students with knowledge of the fundamental principles of the molecular and cellular biology of cancer cells. Students will learn the nature of cancer, the role of growth factors, cellular oncogenes, tumor suppressor genes, angiogenesis, metastasis, and signal transduction mechanisms in tumor formation. Principles of anticancer drug action and many aspects of immunology, neurobiology, developmental biology related to cancer will be discussed.

BIO506 Biochemistry of Diseases

This course applies basic biochemistry and analytical chemistry to medical diagnosis, treatment and management. It provides a sound, objective basis on which to gauge the extent of a clinical disorder, the biochemical consequences of a particular disease process, and the response to therapy.

BIO507 Biomolecular Network

This course will introduce complex biomolecular interaction networks for example, metabolic networks, regulatory networks and signaling networks. General and specific aspects of cellular signaling pathways and their function in the regulation of cellular processes will be covered.

BIO508 Structural Biology

This course will introduce molecular structure of biological macromoloecules, especially proteins and nucleic acids. This course will cover major methods to determine the three-dimensional structure of protein, how the structures are closely related with their functions. Practical aspect also will be covered.

BIO509 Protein Engineering

This advanced course will cover the broad aspects of proteins, including protein folding, structures, dynamics and functions. Particular focuses will be protein-protein interactions, protein structure-function or/and dynamics-function relationships, and protein macromolecular complexes. Various analytical methods, including spectroscopic and spectrometric tools, and the perspectives on biomedical and industrial applications of engineered proteins will also be discussed.

BIO601 Protein Crystallography

X-ray crystallography is one of the powerful methods to solve the protein three-dimensional structure at atomic level resolution. The main objective of this lecture is to introduce the fundamental principles and techniques of protein X-ray crystallography. The lecture will include macromolecule crystallization method, basic mathematics for crystallography, diffraction theory, data collection, model building and refinement, graphic visualization and structural analysis. Practical aspects of crystallography will be also covered in the class.

BIO602 Signal Transduction in Cells

All aspects of signal transduction pathways will be introduced. A series of lectures on cell division and its mechanisms following extracellular signals in both healthy subjects and disease conditions will be given. In particular, deteriorated signal transduction pathways, due to aging, will be discussed through a series of presentations on recent research findings.

BIO603 Current topics in Immunology I

A series of presentations and discussions on recent research achievements published in top-notch immunology journaLS will equip graduate students with up-to-date knowledge and techniques in the field of immunology, which improve their performance as independent researchers.

BIO604 Neurobiology

This course is intended to introduce graduate students to a broad survey of the basic concepts of neuroscience. The course is organized into a series of modules discussing levels of neurobiological functions that range from molecular through behavioral and cognitive processes, and covering topics such as the action potential, molecular mechanisms of synaptic release, neurotransmitters, sensory and motor processing, emotion, cognition and various neurological disorders.

BIO605 Biomaterial and Nanobiotechnology

This course will review current developments of nanobiotechnology utilizing biomaterials such as nucleic acids, proteins, and carbohydrates and their impacts on nanotechnology, biomedical research, and industry. This course particularly focuses on learning how to utilize biomaterials for nanotechnology and biomedical research and what kinds of important techniques are used to study biomimetic nanobiotechnology.

BIO606 Analytical Chemistry of Biomolecules

This course will deal with the characterization and analysis of biomolecules, such as nucleic acids, carbohydrates, and proteins in depth. This course will particularly focus on the fundamental understanding of various types of analytical tools, including electrochemical, chromatographic, spectroscopic, and spectrometric methods, to study the structures and functions of biomolecules. Instrumental details will also be discussed.

BIO607 Advanced Microbial Physiology

This class will look into the inner workings of microbial growth and metabolism. Emphasis will be given to the study of transport systems, metabolic balances (redox/mass/energy), metabolic flux analysis, genetic regulation and the effects of environmental stimuli on the gene expression patterns, with a general focus on bioproduction and whole-cell biosensor systems.

BIO608 Advanced Endocrinology and Metabolism

Westernized societies are confronting an epidemic surge in the incidence of obesity and its attendant co-morbidities. Foremost among these is type 2 diabetes, which is projected to reach a global incidence of 300 million cases by the year 2020. The major goal of this lecture is to provide how obesity and metabolic diseases can be caused and what is the best way to manage the metabolic disorders. For this, this lecture encourages interactions between basic and translational researches. Accordingly, this lecture will concentrate on signaling and regulation of endocrinology in animal systems and in man. Also, this class will provide current insights how mammalian cells can operate their own cellular metabolism and these metabolic pathways can result in systemic metabolism.

BIO701 Molecular Physiology

The primary goal of this course is to develop understanding of the principles of the physiological processes at the molecular level. This course will provide a timely summary of the molecular and cellular mechanisms underlying physiological processes. The structure-function relationship among signaling biomolecules will be discussed.

BIO702 Current Topics in Immunology II

This is an advanced immunology class where immune systems in health and diseases will be discussed. Students will also learn about developments and functions of various immune cells as well as experimental technologies used in immunology. Mainly, current immunological research topics will be discussed.

BIO703 Topics in Genome Data Analysis

This course covers various data analysis methods for genome data including multivariate analysis, machine learning and graph algorithms. Applications for microarray and next generation sequence data are included.

BIO704 Current Topics of Biomedical Research

This course is designed to cover the state-of-the-are technologies and future directions in the field of biomedical engineering. Special interests are focused on artificial tissues to replace that of human and diagnostic devices for medical applications.

BIO705 Mitochondria Biology

With the recent renaissance in mitochondrial biology and increasing recognition of their role in many important human diseases, this course will provide a timely summary of the current state-of-the-art mitochondrial research. This class covers structure and function of mitochondria, dynamics of mitochondria, and the biochemistry of oxidative stress and mitochondrial cell signaling. Mitochondrial implications of important human diseases such as neurodegeneration, cancer, aging, heart attack, and stroke will be discussed.

BIO706 Statistical Genetics

This course covers topics in evolution and population genetics as well as related statistical methods

BIO707 Advanced Structural Biology

This course will generally elucidate the cellular biophysical function of the proteins. The lecture will focus on biophysical activities such as the cell cycle, epigenetics, DNA metabolism, vesicular trafficking, cytoskeleton, signal transduction and membrane biology, in terms of protein structure. The lecture will also cover how to develop and design small molecules for specific diseases (cancer, neurodegenerative disease, etc) that were caused by malfunctions of these proteins.

BIO708 Current Topics in Protein Engineering

This course is intended to introduce the principles and techniques of protein engineering to develop novel tools which help understand from protein functions to diverse diseases in molecular and cellular level. A series of techniques including chemical and light inducible protein modifications will be discussed. Students will be able to understand the up-to-date protein engineering and develop new tools and improve their performance in their research fields.

BIO709 Current Topics in Cellular Physiology

This course is planned to introduce the principles and techniques of cellular physiology. Students will participate in a series of presentations and discussions which help them understand the field of cellular physiology and apply experimental techniques/technologies to their research.

BIO710 Current Topics in Developmental Biology

In this course, students will review recent literature in cell and developmental biology. Students must be actively involved in discussion and also have to exchange their opinion. The topics and literature can be selected by students or instructor.

BIO711 Current Topics in molecular medicine

Molecular and cellular mechanism underlying a variety of common diseases such as diabetes, hypertension, and atherosclerosis is being uncovered at a breath-taking pace. This course is designed to keep up with the progress by reviewing up-to-date literature. Critical review of the literature will be achieved by free exchange of questions and ideas.

BIO712 Current Topics in Stem Cell Biology

This course will review current research and publications related to stem cell biology.
Students will be able to understand current topic in stem cell biology easily through a series of presentations and discussions.

BIO713 Patho-biotechnology

This course introduces the idea of patho-biotechnology, which is defined in this context as the use of pathogenic processes, virulence factors or other effectors to biotechnological applications. As a relatively new field of science, the topics covered will be both novel and creative, spanning from bacterial ghosts as vaccines to the application of bacteria with cancer treatments and as vehicles for RNAi delivery.

BIO801-810 Special Lectures in Biological Sciences A-J

This course is designed to introduce the current trends and the state-of the-art states of various research areas in life sciences. To keep the flexibility of the course, the topics and the instructors will be changed every semesters.

BIO590 The Seminars

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

BIO690 Master's Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

BIO890 Doctoral Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Industrial Design

□ Industrial Design [ID] [산업디자인, ID]

Design emerged from practice and its academic research history is short. These provide a great potential to develop the design research area. With the vision to lead global design research direction, the graduate program of UNIST Industrial Design Department aims at creating design knowledge that contributes to the development of design academically and practically.
We have two research directions for achieving the aim. The first is to trailblaze world-class interdisciplinary design research areas. As design takes an essential role across various industries, combined researches with design and its adjacent disciplines are required. Students from various fields - design, engineering, social science, humanities or etc - will experience pioneering combined design researches leading global academic design society. The second is to pursue contributable research to industry and society. As design is an applied science, we seek transfer academic research result into industry and use industrial phenomena as academic research ingredients.
We offer MS, Ph.D. and MS/Ph.D. combined programmes. The MS programme focuses on building a ground for creating design knowledge through practicing research methods and exploring design practice and theory. The Ph.D. programme pursue to create world-class design knowledge with in-depth design research and apply its result in industry and society.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Industrial Design

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	DHE501	Experimental	Transdisciplinary System Deisgn Practice I	통합적 협동 시스템 개발 실습 I	3-0-6		O
Elective	DHE502	Experimental	Transdisciplinary System Deisgn Practice II	통합적 협동 시스템 개발 실습 II	3-0-6	DHE501	O
Elective	DHE503	Experimental	Transdisciplinary System Deisgn Practice III	통합적 협동 시스템 개발 실습 III	3-0-6		O
Elective	DHE504	Experimental	Master Graduation Project	석사졸업과제	2-0-4	DHE502	O
Elective	DHE590	Lecture	The Seminars	세미나	1-1-0		
Elective	DHE690	Research	Master's Research	석사논문연구	Value of Credit		
Elective	DHE890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective	DHE510	Lecture	Research Methodology	연구방법론	3-3-0		
Elective	DHE511	Lecture	Advanced Topics in Design Research	고등디자인연구논제	3-3-0		
Elective	DHE518	Lecture	Innovative Product Development	혁신제품개발	3-3-0		
Elective	DHE519	Lecture	Design Engineering Theory & Methodology	디자인공학이론과방법론	3-3-0		
Elective	DHE520	Lecture	Design Practice: Theory and Methodology	디자인 실무: 이론과 방법	3-3-0		
Elective	DHE525	Lecture	Product-Service System Design	제품서비스시스템 디자인	3-3-0		
Elective	DHE526	Lecture	Human-centered Design	인간중심디자인	3-3-0		
Elective	DHE527	Lecture	Interaction Design	인터랙션디자인	3-3-0		
Elective	DHE533	Lecture	Project Leadership	프로젝트리더쉽	3-3-0		
Elective	DHE534	Lecture	Brand & Product Strategy	브랜드와 제품전략	3-3-0		
Elective	DHE711	Lecture	Research Issues in Design Engineering	디자인공학연구논제	3-3-0		
Elective	DHE712	Lecture	Sustainable Design	서스테이너블디자인	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	DHE726	Lecture	Contextual Design	컨텍스츄얼디자인	3-3-0		
Elective	DHE728	Lecture	Advanced Topics in Product System Design	고등제품시스템디자인논제	3-3-0		
Elective	DHE733	Lecture	Design Marketing Informatics	디자인마케팅정보론	3-3-0		
Elective	DHE734	Lecture	Design Policy & strategy	디자인정책과전략연구	3-3-0		
Elective	IID801	Lecture	Special Topics in IID1	통합산업디자인 특론 1	3-3-0		
Elective	IID802	Lecture	Special Topics in IID2	통합산업디자인 특론 2	3-3-0		
Elective	IID803	Lecture	Special Topics in IID3	통합산업디자인 특론 3	3-3-0		
Elective	IID804	Lecture	Special Topics in IID4	통합산업디자인 특론 4	3-3-0		
Elective	IID805	Lecture	Special Topics in IID5	통합산업디자인 특론 5	3-3-0		

□ Description

DHE501 Transdisciplinary System Design Practice I [통합적협동시스템개발실습 I]

This is the first of a two course sequence that aims to provide graduate design and engineering students with transdisciplinary design experience in dealing with real-world product development projects. Students will work in design teams and undertake practical design projects from conceptual design to production and business modeling.

DHE502 Transdisciplinary System Design Practice II [통합적협동시스템개발실습 II]

This is the second of the two project-centered courses that provides an open-ended design experience through the creative and disruptive collaboration of all design, engineering and business disciplines. In particular, this second course focuses on transdisciplinary industry-sponsored and global design projects offered in conjunction with the UNICIAD (UNIst Collaborative, Integrative, Applicative Design) global design program.

DHE503 Transdisciplinary System Design Practice III [통합적협동시스템개발실습 III]

This course introduces recent research topics (e.g., Industrial Design, Engineering Design, Ergonimics, HCI, UX, Innovation) that are commonly addressed across disciplines, and discuss the differences in research approach among disciplines. It covers basic and advanced knowledges and methodologies involved in transdisciplinary research.

DHE504 Master Graduation Project [석사졸업과제]

This course is offered for Master Students who take Practice-Oriented Masters Program aiming at fostering competent design engineers who have Integrated perspective, creative problem-solving knowledge and skills and business mind. Students define a problem and deliver a practical solution using various methods and techniques coming from design, engineering, business and so forth. Students in Practice-oriented Masters Program should take this course for two semesters in a row. Patent application, award wining, outcome transfer into a business or publication of research outcome is expected.

DHE590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

DHE690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

DHE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

DHE510 Research Methodology [연구방법론]

This is an advanced lecture course to study various research methods which form the fundamentals of design research. Students are expected to learn systematic understanding of research methods and research process, which will lead them to conduct students' master or doctoral research.

DHE511 Advanced Topics in Design Research [고등디자인연구논제]

This study is designed to construct a holistic view of design theories and issues discussed in design academia. Students are asked to build a perspective of understanding current stream of design research issues.

DHE518 Innovative Product Development [혁신제품개발]

Theory and practice related to innovation are covered in this course. Students explore how and why innovation happens by analyzing innovation cases and various things surrounding innovation such as technologies, human needs, design processes, manufacturing methods etc. and by conducting a product development project.

DHE519 Design Engineering Theory and Methodology [디자인공학이론과방법론]

Students will explore design theory and methodology. Participants will analyze the difference and commonality of design methods and processes between industrial design and engineering design.

DHE520 Design Practice Theory and Methodology [디자인실무: 이론과 방법]

Students will explore the theories and methodologies that inform an understanding of contemporary design practice. Through this exploration the course will foster awareness of how the pragmatic act of designing relates to designerly ways of thinking and knowing. The course's aim is to provide students with a more informed, critical and holistic understanding of design and the act of designing.

DHE525 Product-Service System Design [제품서비스 시스템디자인]

This course aims at exploring a holistic experience of designing a system composed of product-service mix. Students will be guided with systemic thinking and need-oriented approach to resolve various issues including social, environmental, and economic ones.

DHE526 Human-centered Design [인간중심디자인]

This course is a project-based introduction to the design of products and processes that meet human needs. Students are given a problem area in which to innovate and will be led through the process of investigating cultural, emotional, technological, and business factors to develop new concepts, creating and testing prototypes, and iterative designs. Principal focus will be placed on understanding the interaction between people, products, and services. The course includes lectures, labs, assigned readings, homework assignments and projects.

DHE527 Interaction Design [인터랙션디자인]

This is a lecture / studio course to study general theories on usability regarding learning-ability, efficiency, memorability, satisfaction for information appliances or media. Students are to learn diverse methods related with usability such as heuristic evaluation, task analysis and usability testing so that they can have the capability to lead user-centered design.

DHE533 Project Leadership [프로젝트리더쉽]

This course will explore leadership theory in the context of business and project management. Student will learn how to organize teams, manage resources, set goals and objectives with emphasis on working in multi-disciplinary environments. Theoretical underpinnings of communication theory and other related disciplines will also be explored.

DHE534 Brand & Product Strategy [브랜드와 제품전략]

This course bridges branding and product theory with practical skills to build a holistic brand, service, product strategy. Students will develop the key business planning skills by examining business case studies, product platforms, product life-cycles and marketing issues, and the mobilization of the necessary business resources to bring an idea to market.

DHE711 Research Issues in Design Engineering [디자인공학연구논제]

In this course, emerging topics of special interest in the combined areas of design and engineering will be selected under the guidance of a faculty member, and the student will present and discuss the current researches.

DHE712 Sustainable Design [서스테이너블디자인]

"Sustainability" is becoming as a driving force in the spheres of business, socio-economic development and the environment. Studying the concept of design for everybody and for society will provide students new perspectives to the aspect of ethics and standards as a designer. This course deals with universal design, eco design and social design as new business models.

DHE726 Contextual Design [컨텍스츄얼디자인]

The course aims at teaching user-centered design methods for identifying users' hidden needs so that innovative design can be created. User-centered methods from stage of planning to idea-generation and evaluation will be covered including user-observation, scenario-based design, self-camera, user-diary, usability testing, user-participatory design etc. Students are expected to build up the capability to plan creative design concepts and conduct user-studies.

DHE728 Advanced Topics in Product System Design [고등제품시스템디자인논제]

In this course, advanced topics of special interest in the areas of Product System Design will be selected under the guidance of a faculty member, and the student will present and discuss the current researches.

DHE733 Design Marketing Informatics [디자인마케팅정보론]

This is a lecture course to study consumer and market behavior related to new product designs. Students are to learn diverse marketing survey methods, statistical analysis, product positioning, market segmentation, life style analysis, and concept evaluation.

DHE734 Design Policy and Strategy[디자인정책과전략연구]

This course aims at understanding the position and roles of design in a company, government and any organizational structure. Using case studies, students will examine design policies and strategies to strengthen the competitiveness of an organization.

IID801,802,803,804,805 Special Topics in IID 1,2,3,4,5 [통합산업디자인 특론 1,2,3,4,5]

This course consists of students-led seminars on contemporary topics in Design Research and Practice.

Department of Human & Systems Engineering

□ Human & Systems Engineering [HSE] [인간및시스템공학과, HSE]

Department of Human and Systems Engineering focuses on the design and development of innovative products, processes and systems by integrating knowledge across multiple engineering disciplines. The curriculum of HSE is structured to provided students with deep knowledge and practical skills in system design engineering (e.g. modeling and simulation, signal processing, optimization), human factors engineering (e.g. ergonomics, affective engineering, human-centered design), and applied statistics. The knowledge and skills will be applicable across various types of products and systems, including: human-machine interfaces, health care products and systems, transportation systems, mechatronic systems, and manufacturing systems.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Human & Systems Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	DHE501	Experimental	Transdisciplinary System Deisgn Practice I	통합적 협동 시스템 개발 실습 I	3-0-6		O
Elective	DHE502	Experimental	Transdisciplinary System Deisgn Practice II	통합적 협동 시스템 개발 실습 II	3-0-6	DHE501	O
Elective	DHE503	Experimental	Transdisciplinary System Deisgn Practice III	통합적 협동 시스템 개발 실습 III	3-0-6		O
Elective	DHE504	Experimental	Master Graduation Project	석사졸업과제	2-0-4	DHE502	O
Elective	DHE590	Lecture	The Seminars	세미나	1-1-0		
Elective	DHE690	Research	Master's Research	석사논문연구	Value of Credit		
Elective	DHE890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective	DHE540	Lecture	Human Factors Research Design	인간공학연구설계	3-3-0		
Elective	DHE541	Lecture	Human Factors Systems Design	인간공학시스템설계	3-3-0		
Elective	DHE542	Lecture	Advanced Multivariate Methods & Data Mining	고등다변량기법과데이터마이닝	3-3-0		
Elective	DHE543	Lecture	Human Performance in Transportation System	교통시스템과인간수행력	3-3-0		
Elective	DHE544	Lecture	Macroergonomics	매크로얼고노믹스	3-3-0		
Elective	DHE550	Lecture	Occupational Biomechanics	작업 생체 역학	3-3-0		
Elective	DHE551	Lecture	Advanced Auditory Display Design	고등청각디스플레이설계	3-3-0		
Elective	DHE558	Lecture	Human Information Processing	인간정보처리	3-3-0		
Elective	DHE740	Lecture	Special Topics in Human Factors 1	인간공학 특론 1	3-3-0		
Elective	DHE741	Lecture	Special Topics in Human Factors 2	인간공학 특론 2	3-3-0		
Elective	DHE742	Lecture	Special Topics in Human Factors 3	인간공학 특론 3	3-3-0		
Elective	DHE743	Lecture	Special Topics in Human Factors 4	인간공학 특론 4	3-3-0		
Elective	DHE745	Lecture	Techniques and Methodologies in Ergonomics 1	인간공학기법과방법론 1	3-3-0		
Elective	DHE746	Lecture	Techniques and Methodologies in Ergonomics 2	인간공학기법과방법론 2	3-3-0		
Elective	DHE747	Lecture	Techniques and Methodologies in Ergonomics 3	인간공학기법과방법론 3	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	DHE748	Lecture	Techniques and Methodologies in Ergonomics 4	인간공학기법과방법론 4	3-3-0		
Elective	DHE560	Lecture	Color Science	색채과학	3-3-0		
Elective	DHE561	Lecture	Psychophysics	정신물리학	3-3-0		
Elective	DHE562	Lecture	Cross-media color reproduction	크로스미디어컬러리프로덕션	3-3-0		
Elective	DHE563	Lecture	Color System	색채시스템	3-3-0		
Elective	DHE564	Lecture	Color Psychology	색채심리학	3-3-0		
Elective	DHE565	Lecture	Research Topics in Color Science & Engineering I	색채공학특강I	3-3-0		
Elective	DHE566	Lecture	Research Topics in Color Science & Engineering II	색채공학특강II	3-3-0	DHE501	
Elective	DHE701	Lecture	Advanced Topics in High Touch	하이터치 고등논제	3-3-0		
Elective	DHE761	Lecture	Human Vision	인간시각	3-3-0	DHE502	
Elective	DHE762	Lecture	Advanced Color Science	고급색채과학	3-3-0		
Elective	DHE763	Lecture	Color & Emotion	감성색채	3-3-0		
Elective	DHE764	Lecture	Advanced Topics in Color Science & Engineering I	고급색채공학특강I	3-3-0		
Elective	DHE765	Lecture	Advanced Topics in Color Science & Engineering II	고급색채공학특강II	3-3-0		
Elective	DHE790	Lecture	Research Practicum in Human Factors	인간공학 연구주제	3-3-0		
Elective	DHE570	Lecture	Advanced Engineering Design Methods	고등공학디자인기법	3-3-0		
Elective	DHE580	Lecture	Digital Product Development	디지털제품개발	3-2-2		
Elective	DHE571	Lecture	Root Cause Analysis	근본원인분석	3-3-0		
Elective	DHE581	Lecture	Reverse Engineering & Rapid Prototyping	역설계 및 신속조형	3-3-0		
Elective	DHE582	Lecture	Virtual Manufacturing System	가상생산시스템	3-2-2		
Elective	DHE572	Lecture	Product Lifecycle Management	PLM	3-2-2		
Elective	DHE583	Lecture	Modern Vehicle Design	자동차설계	3-3-0		
Elective	DHE584	Lecture	Vehicle Electronics	자동차전자공학	3-3-0		
Elective	DHE770	Lecture	Design Knowledge Management	디자인지식관리	3-3-0		
Elective	DHE771	Lecture	Eco-design	친환경설계	3-3-0		
Elective	DHE773	Lecture	Advanced Topics in Engineering Design	공학디자인고등논제	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	DHE780	Lecture	Advanced Topics in Vehicle Design	자동차설계고등논제	3-3-0		
Elective	ESD801	Lecture	Special Topics in ESD1	공학 및 시스템 디자인 특론 1	3-3-0		
Elective	ESD802	Lecture	Special Topics in ESD2	공학 및 시스템 디자인 특론 2	3-3-0		
Elective	ESD803	Lecture	Special Topics in ESD3	공학 및 시스템 디자인 특론 3	3-3-0		
Elective	ESD804	Lecture	Special Topics in ESD4	공학 및 시스템 디자인 특론 4	3-3-0		
Elective	ESD805	Lecture	Special Topics in ESD5	공학 및 시스템 디자인 특론 5	3-3-0		

☐ Description

DHE501 Transdisciplinary System Design Practice I [통합적협동시스템개발실습 I]

This is the first of a two course sequence that aims to provide graduate design and engineering students with transdisciplinary design experience in dealing with real-world product development projects. Students will work in design teams and undertake practical design projects from conceptual design to production and business modeling.

DHE502 Transdisciplinary System Design Practice II [통합적협동시스템개발실습 II]

This is the second of the two project-centered courses that provides an open-ended design experience through the creative and disruptive collaboration of all design, engineering and business disciplines. In particular, this second course focuses on transdisciplinary industry-sponsored and global design projects offered in conjunction with the UNICIAD (UNIst Collaborative, Integrative, Applicative Design) global design program.

DHE503 Transdisciplinary System Design Practice III [통합적협동시스템개발실습 III]

This course introduces recent research topics (e.g., Industrial Design, Engineering Design, Ergonimics, HCI, UX, Innovation) that are commonly addressed across disciplines, and discuss the differences in research approach among disciplines. It covers basic and advanced knowledges and methodologies involved in transdisciplinary research.

DHE504 Master Graduation Project [석사졸업과제]

This course is offered for Master Students who take Practice-Oriented Masters Program aiming at fostering competent design engineers who have Integrated perspective, creative problem-solving knowledge and skills and business mind. Students define a problem and deliver a practical solution using various methods and techniques coming from design, engineering, business and so forth. Students in Practice-oriented Masters Program should take this course for two semesters in a row. Patent application, award wining, outcome transfer into a business or publication of research outcome is expected.

DHE590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

DHE690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

DHE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

DHE540 Human Factors Research Design [인간공학연구설계]

Procedures for conducting and analyzing human factors and ergonomics experiments, including fundamentals of research, design alternatives, fitting and testing statistical models, and data interpretation and presentations. Primary focus on linear regression (simple and multiple) and analysis of variance (single and multiple factor) will be explored in depth.

DHE541 Human Factors System Design [인간공학시스템설계]

This course explores human factor inputs into operator-system design, development, testing, and evaluation. Lectures will cover specific methodologies and techniques and how they related to the design and selection of engineering modeling and manual control systems.

DHE542 Advanced Multivariate Methods & Data Mining [고등다변량기법과 데이터마이닝]

This course explores advanced multivariate and data mining methods. Primacy will be given to the analysis of multivariate distributions, location and dispersion problems for one and two samples, multivariate analysis of variance, linear models, repeated measurements, inference for dispersion and association parameters, principal components, discriminant and cluster analysis, and simultaneous inference.

DHE543 Human Performance in Transportation Systems [교통시스템과 인간수행력]

The principles objectives of this course are to explore: 1) the basic principles of human performance, human error, and human behavior applied to transportation systems, 2) the principles of transportation systems design for human performance improvements, 3) the principles and practices of empirical evaluation of human, vehicular, and infrastructure interaction.

DHE544 Macroergonomics [매크로얼고노믹스]

The course explores the optimization of work system design through consideration of relevant personnel, technological, and environmental variables and their interactions. Emphasis is placed on theoretical background, research methods, analyses, design, development and applications of work systems and the relationship between macro and micro-ergonomics.

DHE550 Human Physical Capabilities [작업 생체 역학]

This course explores the modeling, analysis, and evaluation of industrial workplaces with emphasis on the physical demands placed on and the capabilities of workers. Topics covered include: physiology, anthropometry, bioinstrumentation, and biomechanics. Students will learn and apply a range of contemporary analytical and assessment methods.

DHE551 Advanced Auditory display Design [고등청각디스플레이설계]

This course is an examination of the human sensory and perceptual experience of sound, with emphasis on relating the capabilities and limitations of audition to the design of auditory display systems and to noise abatement in hearing conservation efforts. In addition to discussion of human sound reception and sensitivity, human psychological and physiological responses to sound will be covered.

DHE558 Human Information Processing [인간정보처리]

An examination of human information reception, information processing, and skilled performance capabilities and limitations in human-machine systems with an emphasis on models and techniques, including psychophysics, signal detection theory, information theory, supervisory control, and decision theory.

DHE740,741,742,743 Special Topics in Human Factors 1,2,3,4 [인공공학 특론 1,2,3,4]

This course consists of students-led seminars on contemporary topics in Human Factors.

DHE745,746,747,748 Techniques and Methodologies in Ergonomics [인간공학기법과 방법론 1,2,3,4]

This course reviews contemporary techniques and methodologies used in Cognitive and Physical Ergonomics, most of which will be presented by students rather than by the instructor.

DHE560 Color Science [색채과학]

This course covers the principles of color science. Components include human visual system, CIE colorimetry, color measuring instruments, psychophysical scaling methods, models for color difference and color appearance, color order systems. It aims to equip students with thorough understanding of the principles of color science to be able to apply these for solving industrial problems.

DHE561 Psychophysics [정신물리학]

Psychophysics is the scientific discipline about the relation between physical stimulus and human sensation. This course focuses on the psychophysical experimental methods and data analysis for human visual perception researches.

DHE562 Cross-media color reproduction [크로스미디어컬러리프로덕션]

Color signal control methods such as device characterization and gamut mapping are introduced to reproduce the same colors on the various imaging devices.

DHE563 Color System [색채시스템]

Various color order systems such as Munsell and NCS and the color harmony theories are studied.

DHE564 Color Psychology [색채심리학]

The psychological effects of colors are studied.

DHE565, DHE566 Research Topics in Color Science & Engineering I, II [색채공학특강 I, II]

This course is designed for Master course students to introduce the current trends and the state-of the-art color science & engineering. To maintain flexibility in this course, the topics and the instructors will be changed every semesters.

DHE701 Advanced Topics in High Touch [하이터치 고등논제]

In this course, basic and advanced topics in high touch design will be discussed. Students are required to apply the high touch design process for their term project.

DHE761 Human Vision [인간시각]

The process of human visual perception starting from the retina to the visual cortex is studied along with various adaptation process.

DHE762 Advanced Color Science [고급색채과학]

This course introduces the latest researches on color science & engineering field conducted at the related international standard organization such as the International Commission on Illumination (CIE) or International Electrotechnical Commission (IEC).

DHE763 Color & Emotion [감성색채]

The color emotion scaling methods are studied based on color psychology.

DHE764, DHE765 Advanced Topics in Color Science & Engineering I, II [고급색채공학특강 I, II]

This course is designed for PhD course students to introduce the current trends and the state-of the-art color science & engineering. The topics and the instructors in this course will be regularly updated to provide students with the latest findings and methodologies in this rapidly evolving field.

DHE790 Research Practicum in Human Factors [인간공학 연구주제]

This course is intended to provide PhD students with a practical research experience in the area of cognitive or physical ergonomics area by planning and conducting a research project. Final outcome of this course is a journal submission ready manuscript.

DHE570 Advanced Engineering Design Methods [고등공학디자인기법]

This course covers advanced optimisation techniques, interval arithmetic, constraint satisfaction & propagation algorithms and Multiple Criteria Decision Analysis (MCDA) and distributed Artificial Intelligence (DAI) as design verification and evaluation methods. Uncertainty theories and normative/prescriptive theories of decision making will be discussed to model imprecise information and the choice under risk in early phase design. Theoretical exercises with case studies will complement the course.

DHE580 Digital Product Development [디지털제품개발]

This course examines the state-of-the-art digital infrastructure to plan, design, manufacture and validate of new products. The course introduces the student to a wide range of basic topics in the geometrical modeling & system modeling methods. The student will understand how computer graphics including virtual and augmented reality (VR/AR) is used in product design. The student will also learn how to integrate design, engineering and manufacturing, and how to simulate the entire product development process in a virtual environment.

DHE571 Root Cause Analysis [근본원인분석]

Root Cause Analysis (RCA) methods and No Fault Found (NFF) phenomena will be introduced as product diagnostics methods. The course covers data analysis, fault identification and elimination. Some topics from the state-of-the-art in vehicle diagnostics will be offered selectively each year.

DHE581 Reverse Engineering & Rapid Prototyping [역설계 및 신속조형]

This course studies the systematic process to extract the technological principles and knowhow of existing products and other systems. In particular, the course introduces some methods to digitize an existing physical part (e.g. 3D scanning) and construct CAD models of the parts. The concept and tools for rapid prototyping such as Stereo Lithography Apparatus (SLA), Selective Laser Sintering equipments (SLS) and 3D printing will be introduced.

DHE582 Virtual Manufacturing System [가상생산시스템]

This course studies virtual manufacturing technologies to construct, control and maintain virtual factories, by using commercial solutions. The student learns virtual machining and digital mock-up to discover potential faults causes in product/process designs as well as manufacturing system layout. Robot Off-Line-Programming (OLP) will also be discussed.

DHE572 Product Lifecycle Management PLM

This course studies the concept and application of product lifecycle management (PLM), and covers Beginning of Lifecycle (BOL), Middle of Lifecycle (MOL), and End of Lifecycle (EOL) managements while placing emphasis on emerging information technologies and decision making issues. Through this course, the student will learn the in-depth understanding of lifecycle engineering.

DHE583 Modern Vehicle Design [자동차설계]

The student studies the essential topics in modern vehicle design such as styling and aerodynamics in vehicle body design; modern materials for vehicle; new manufacturing challenges crash worthiness; vehicle control systems; suspension system & components; engine design; transmission & driveline; and braking systems. Future trends in vehicle design will be discussed. Industry experts will be invited to lecture on the challenges of modern vehicular design.

DHE584 Vehicle Electronics [자동차전자공학]

This course introduces students to automotive electronics focusing on sensors, actuators, and control systems. Vehicle telemetry/diagnostics systems including required embedded systems will be studied.

DHE770 Design Knowledge Management [디자인지식관리]

This course deals with information & communication technology-based infrastructure to represent, store, acquire, classify, analyze, and finally share design information and knowledge. The student will thus learn why information management is important in collaborative design, and how information management supports the current design process as well as design knowledge proliferation.

DHE771 Eco-design [친환경설계]

This course studies how to design a recyclable product and its reconfigurable manufacturing process in order to minimize environmental impacts of the product during its whole lifecycle. In particular, the students will discuss about how to reduce energy consumption, minimize CO_2 emission and save natural resources such as air, water and other materials.

DHE773 Advanced Topics in Engineering Design [공학디자인고등논제]

In this course, advanced topics of special interest in the various areas of engineering design will be selected under the guidance of a faculty member, and the student will present and discuss the current researches.

DHE780 Advanced Topics in Vehicle Design [자동차설계고등논제]

In this course, advanced topics of special interest in the various areas of vehicle design will be selected under the guidance of a faculty member, and the student will present and discuss the current researches.

ESD801,802,803,804,805 Special Topics in ESD 1,2,3,4,5 [공학및시스템디자인 특론 1,2,3,4,5]

Advanced topics of special interest from the state-of-the-art in engineering design research will be offered selectively each year. Students, faculties and invited speakers will exchange contemporary research issues and technical advances in engineering design.
This is the first of a two course sequence that aims to provide graduate design and engineering students with transdisciplinary design experience in dealing with real-world product development projects. Students will work in design teams and undertake practical design projects from conceptual design to production and business modeling.

Department of Urban and Environmental Engineering

□ Urban and Environmental Engineering [UEE]

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 department, students will study advanced courses represented by three programs:

1) Environmental Science and Engineering (ESE)

The program is an inter-disciplinary major to understand the environmental issues on global and regional scales including climate change. Enrolled students research the science- and engineering-based methodologies to reconstruct the past, monitor the present, and predict the future of the Earth system on various temporal and spatial scales, based on the integrated knowledge of atmospheric, oceanic, and earth sciences. The program also aims to develop state-of-the-art engineering technologies to achieve those scientific goals.

2) Urban Infrastructure Engineering (UIE)

The program contributes to developing smart green cities on our planet’s future, through consistent research on principles essential to create the built environment desired for fertile human life and on never-ending problems confronted during the process. It includes interdisciplinary pursues in the field of civil engineering and urban planning.

3) Disaster Management Engineering (DME)

The DME program pursues interdisciplinary education and research in collaboration with researchers in urban/civil engineering, environmental engineering, earth/environmental science, and disaster management to mitigate the impact of unexpected disasters. It focuses on natural hazard prediction, sustainable and resilient infrastructure, disaster risk reduction/prevention, disaster mitigation and preparedness, disaster response and recovery, and disaster risk management policy. This program also provides educational opportunities for the next generation of disaster researchers and professionals.

☐ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Urban and Environmental Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Required	UEE690	Research	Master's Research	석사논문연구	Value of Credit		
Required	UEE890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective	ENV590	Research	The Seminars	세미나	1-1-0		
Elective	ENV501	Lecture	Advanced Environmental Engineering	고급환경공학	3-3-0		
Elective	ENV503	Lecture	Environmental Organic Chemistry	환경유기화학	3-3-0		
Elective	ENV505	Lecture	Wastewater Microbiology	폐수미생물학	3-3-0		
Elective	ENV506	Lecture	Waste Management	폐기물관리	3-3-0		
Elective	ENV601	Lecture	Wastewater Treatment and Process Design	수처리공정설계	3-3-0		
Elective	ENV604	Lecture	Aquatic Chemistry	수질화학	3-3-0		
Elective	ENV605	Lecture	Chemistry for Environmental Engineering and Science	환경화학개론	3-3-0		
Elective	ENV701	Lecture	Environmental Photochemistry	환경광화학	3-3-0		
Elective	ENV702	Lecture	Environmental Nanotechnology	환경나노기술	3-3-0		O
Elective	ENV703	Lecture	Introduction to Advanced Oxidation Technology	고도산화기술개론	3-3-0		
Elective	ENV704	Lecture	Physical and Chemical Treatment Processes	물리화학적 수처리 공정 특론	3-3-0		O
Elective	ENV705	Lecture	Movement and Fate of Organic Contaminants in Water	수계 유기오염물질 거동	3-3-0		
Elective	ENV706	Lecture	Introduction to Membrane Technology to Water/Wastewater Treatment	수처리/폐수처리 분리막 개론	3-3-0		
Elective	ENV707	Lecture	Environmental Biotechnology	환경생명공학기술	3-3-0		
Elective	ENV802	Lecture	Special Topics for Environmental Engineers I	환경공학특론 I	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
	ENV803	Lecture	Special Topics for Environmental Engineers II	환경공학특론 II	3-3-0		
	ENV804	Lecture	Biosensors	바이오센서	3-3-0		
	ENV805	Lecture	Special Topics for Environmental Engineers III	환경공학특론 III	3-3-0		
	ENV806	Lecture	Special Topics for Environmental Engineers IV	환경공학특론 IV	3-3-0		
	ENV807	Lecture	Special Topics for Environmental Engineers V	환경공학특론 V	3-3-0		
	ENV808	Lecture	Special Topics in Environmental Science and Engineering	환경과학공학 특론	3-3-0		O
	EES590	Research	The Seminars1	세미나1	1-1-0		
	EES591	Research	The Seminars2	세미나2	1-1-0		
	EES501	Lecture	Technical Writing and presentation skills for environmental scientists	환경과학자를 위한 글쓰기와 프레젠테이션 기술	3-3-0		
	EES502	Lecture	Introduction to Environmental Analysis	환경분석개론	3-3-0	CHE103 NCS201ESE201	
	EES503	Lecture	Advanced Atmospheric Dynamics I	고급대기역학 I	3-3-0		
	EES504	Lecture	Mass Spectrometry	질량분석학	3-3-0	NCS201	
	EES505	Lecture	Tropical Meteorology	열대기상학	3-3-0		
	EES601	Lecture	Atmospheric Physics	대기물리	3-3-0		
	EES602	Lecture	Gas Hydrates and Climate Change	가스 하이드레이트와 기후변화	3-3-0		O
	EES603	Lecture	Advanced Atmospheric Dynamics II	고급대기역학 II	3-3-0		
	EES604	Lecture	Analysis and Monitoring of Organic Pollutants	유기오염물질 분석 및 모니터링	3-3-0	CHE103, NCS201	
	EES605	Lecture	Air Pollution Management	대기오염관리	3-3-0		
	EES651	Lecture	Remote Sensing of the Environment	환경원격탐사	3-3-0	ESE305	O
	EES701	Lecture	Climate-Environment Modeling	기후환경 모델링	3-3-0		
	EES801	Lecture	Special Course on Climate Change	기후변화 특강	3-3-0		
	EES803	Lecture	Current Topics in Carbon Dioxide Capture and Storage	이산화탄소 회수 및 저장 특론	3-3-0		
	EES810	Lecture	Special Topics in Earth and Environmental Sciences I	지구환경과학 특론 I	3-3-0		
	EES811	Lecture	Special Topics in Earth and Environmental Sciences II	지구환경과학 특론 II	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
	EES812	Lecture	Special Topics in Earth and Environmental Sciences Ⅲ	지구환경과학 특론 Ⅲ	3-3-0		
	EES813	Lecture	Special Topics in Earth and Environmental Sciences IV	지구환경과학 특론 IV	3-3-0		
	EES814	Lecture	Special Topics in Earth and Environmental Sciences V	지구환경과학 특론 V	3-3-0		
	EES851	Lecture	Advanced Modeling Techniques for GIScience Applications	GIScience 응용을 위한 고급 모델링 기법	3-3-0	ESE305	
	UIE590	Research	Seminar	세미나	1-1-0		
	UIE501	Lecture	Continuum Mechanics	연속체역학	3-3-0		
	UIE502	Lecture	Structural Dynamics	구조동역학	3-3-0		
	UIE503	Lecture	Earthquake Resistant Design	내진설계론	3-3-0		O
	UIE504	Lecture	Low-carbon Concrete	저탄소 콘크리트 공학	3-3-0		
	UIE505	Lecture	Research Methods for Urban Studies	도시연구방법론	3-3-0		
	UIE506	Lecture	Urban form and spatial structure	도시형태 및 공간구조	3-3-0		
	UIE507	Lecture	Finite Element Method	유한요소법	3-3-0		
	UIE508	Lecture	Land Use Planning	토지이용계획	3-3-0		
	UIE509	Lecture	Urban Design Workshop	도시설계워크샵	3-3-0		
	UIE510	Lecture	Advanced Engineering Mathematics	고급공학수학	3-3-0		
	UIE601	Lecture	Prestressed Concrete	프리스트레스트 콘크리트	3-3-0		
	UIE602	Lecture	Crack Analysis in Concrete	콘크리트 균열해석	3-3-0		
	UIE603	Lecture	Time-Dependent Properties of Concrete	콘크리트 시간의존적 특성	3-3-0		
	UIE605	Lecture	Real Estate Development and Investment	부동산 개발 및 투자	3-3-0		
	UIE701	Lecture	Stability of Structures	구조안정론	3-3-0		O
	UIE702	Lecture	Nonlinear Finite Element Analysis	비선형 유한요소해석	3-3-0		
	UIE704	Lecture	Concrete Micro-characterization	콘크리트 미세구조분석	3-1-4		
	UIE706	Lecture	City and Neighborhood Revitalization	도시재개발	3-3-0		
	UIE707	Lecture	Theory of Planning	계획이론	3-3-0		
	UIE708	Lecture	Planning for Housing	도시주택론	3-3-0		
	UIE802	Lecture	Rheology of Concrete	콘크리트 레올로지	3-2-2		
	UIE803	Lecture	Regional Economic Modeling	지역경제 모델링	3-3-0		
	UIE810	Lecture	Special Topics in Urban Infrastructure Engineering Ⅰ	도시기반시설공학특론 Ⅰ	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
	UIE811	Lecture	Special Topics in Urban Infrastructure Engineering II	도시기반시설공학특론 II	3-3-0		
	UIE812	Lecture	Special Topics in Urban Infrastructure Engineering Ⅲ	도시기반시설공학특론 Ⅲ	3-3-0		
	UIE813	Lecture	Special Topics in Urban Infrastructure Engineering Ⅳ	도시기반시설공학특론 Ⅳ	3-3-0		
	UIE814	Lecture	Special Topics in Urban Infrastructure Engineering Ⅴ	도시기반시설공학특론 Ⅴ	3-3-0		
	DME590	Research	Seminar	세미나	1-1-0		
	DME502	Lecture	Structural Reliability	구조신뢰성	3-3-0	DME311	O
	DME503	Lecture	Disaster Response and Recovery	재난대응 및 복구	3-3-0		
	DME504	Lecture	Surface Hydrology	지표수문학	3-3-0	ESE332	
	DME505	Lecture	Disaster Mitigation and Preparedness	재난완화 및 대비	3-3-0		
	DME506	Lecture	Numerical Weather Prediction	수치 예보	3-3-0		O
	DME601	Lecture	Disaster Planning and Policy	재난계획 및 정책	3-3-0		O
	DME602	Lecture	Earthquake Engineering	지진공학	3-3-0	UIE502	
	DME603	Lecture	Wind Engineering	풍공학	3-3-0	UIE502	
	DME604	Lecture	Reliability of Infrastructure Systems	사회기반시설시스템의 신뢰성	3-3-0	DME502	
	DME701	Lecture	Disaster Theory and Practice	재난이론과 응용	3-3-0		
	DME702	Lecture	Advanced Numerical Modeling for Weather	고급기상수치모델링	3-3-0	DME421	
	DME703	Lecture	Random Vibrations	불규칙진동론	3-3-0	UIE502	
	DME704	Lecture	Smart Structures	스마트구조	3-2-2	UIE502	
	DME801	Lecture	Special Topics in Disaster Management Engineering I	재난관리공학특론 I	3-3-0		
	DME802	Lecture	Special Topics in Disaster Management Engineering II	재난관리공학특론 II	3-3-0		
	DME803	Lecture	Special Topics in Disaster Management Engineering III	재난관리공학특론 III	3-3-0		
	DME804	Lecture	Special Topics in Disaster Management Engineering IV	재난관리공학특론 IV	3-3-0		
	DME805	Lecture	Special Topics in Disaster Management Engineering V	재난관리공학특론 V	3-3-0		

* Those related to Environmental Science in ESE program and enrolled in 2013 should take the seminars1(EES590) and the seminars2(EES591).

□ Description

UEE690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

UEE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

ENV501 Advanced Environmental Engineering [고급 환경공학]

For graduate students whose major was not environmental engineering, the history of environmental engineering and major disciplines will be introduced.

ENV503 Environmental Organic Chemistry [환경유기화학]

This course focuses on environmental factors that determine the fate of organic chemicals in natural and engineered systems. The knowledge learned from this course is useful to quantitatively assessing the environmental behaviour of organic chemicals.

ENV505 Wastewater Microbiology [폐수미생물학]

The goal of this course is to gain a fundamental understanding of microorganisms and their roles in wastewater environments.

ENV506 Waste Management [폐기물관리]

This course will introduce waste classification, physico-chemical properties, instrumental analysis, waste source, collection and recycling, remediation and treatment and life cycle assessments (LCA).

ENV601 Wastewater Treatment and Process Design [수처리공정설계]

The purpose of this course is to study basic principles of chemical, physical and biological treatment facilities and to design the unit operations and processes of water and wastewater treatment.

ENV604 Aquatic Chemistry [수질화학]

Basic concepts and chemical principles of water chemistry will be introduced, emphasizing the application of the principles to solve the specific chemical problems in aqueous environment, pollution control and purification technology.

ENV605 Chemistry for Environmental Engineering and Science [환경화학개론]

The purpose of this course is to bring into focus some aspects of chemistry which are valuable for solving environmental problems and lay a background of understanding in the area of specialized quantitative analysis, commonly referred to as water and wastewater analysis.

ENV701 Environmental Photochemistry [환경광화학]

The objective of this course is to understand the basic concepts and principles of photochemistry and to gain insight into its implication in environment and the applications in environmental technologies.

ENV702 Environmental Nanotechnology [환경나노기술]

This course introduces the recent research trends about environmental nanotechnologies and also covers the environmental impact of engineered nanoparticles.

ENV703 Introduction to Advanced Oxidation Technology [고도산화기술개론]

This course provides basic concepts and principles of advanced oxidation technologies for environmental remediation which include ozonation, Fenton systems and photocatalytic processes.

ENV704 Physical and Chemical Treatment Processes [물리화학적 수처리 공정 특론]

This course introduce the fundamentals of physical/chemical treatment processes and will help students learn how to design the processes.

ENV705 Movement and Fate of Organic Contaminants in Water [수계 유기오염물질 거동]

This course covers basic principles on the transport of organic chemicals in surface waters and ground-waters. including their sorption, mass transfer, advection, dispersion, etc.

ENV706 Introduction to Membrane Technology to Water/Wastewater Treatment [수처리/폐수처리 분리막 개론]

Fundamental principles of membrane technology with focus on microfiltration, ultrafiltration, nanofiltration and reverse osmosis. Emphasis is on polymer chemistry, synthesis, modification, characterization and degradation of membranes and then application of the membranes to solve problems in aquatic systems.

ENV707 Environmental Biotechnology [환경생명공학기술]

This course introduces applications of biotechnologies and molecular techniques today in environmental engineering with particular emphasis on biological pollutant removal processes.

ENV802 Special Topics for Environmental Engineers I [환경공학특론 I]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV803 Special Topics for Environmental Engineers II [환경공학특론 II]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV804 Biosensors [바이오센서]

Biosensors are tools utilizing at least one biological component, such as DNA, RNA, protein, whole cell, etc., which is used to detect and report on the presence of specific chemicals or groups of chemicals. As such, this class will cover topics related with biosenors, including their classes, development, fabrication, validation and current use in a variety of applications, especially in toxicity sensing.

ENV805 Special Topics for Environmental Engineers III [환경공학특론 III]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV806 Special Topics for Environmental Engineers IV [환경공학특론 IV]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV807 Special Topics for Environmental Engineers V [환경공학특론 V]

In this class we will examine the causes of environmental pollution in the spheres of water, atmosphere, waste, noise and vibration; focus on the effect and prevention counterplan and a comprehensive management plan for prevention of environmental pollution.

ENV808 Special Topics in Environmental Science and Engineering [환경과학공학 특론]

This course covers interdisciplinary topics on environmental science and engineering including environmental pollution and control, environmental analysis, climate change, and earth science.

ENV590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

EES501 Technical writing and presentation skills for environmental scientists [환경과학자를 위한 글쓰기와 프레젠테이션 기술]

This course will address practical methods for technical writing (journal articles) and presentation. Students learn more efficient and successful ways to prepare their own manuscript to be submitted to an international refereed journal.

EES502 Introduction to environmental analysis [환경분석개론]

This course introduces sampling, pretreatment, and instrumental analysis for organic pollutants and heavy metals. The main contents are transport of pollutants, water analysis (major and trace constituents), analysis of solids and waste, atmospheric analysis (gases and particulates), and ultra-trace analysis.

EES503 Advanced Atmospheric Dynamics I [고급대기역학 I]

The course covers fundamentals of geophysical fluid dynamics, which consists of five small topics. We first provide a brief introduction to fluid dynamics and the basic equations of motion. Then, the effects of stratification and rotation is introduced to discuss fundamental topics such as the primitive equations and the Boussinesq equations. Also, we introduce the shallow water equations that forms the simplest expression of many of the principles of geophysical fluid dynamics. We then discuss vorticity and potential vorticity. Finally, we derive simplified equation sets for large-scale flows, e.g. the quasi-geostrophic equations.

EES504 Mass Spectrometry [질량분석학]

This course will introduce the principle and types of mass spectrometry, which has been widely used for trace-level analysis of organic pollutants. The interpretation of mass spectrum and applications for dioxin analysis will be also introduced.

EES505 Tropical Meteorology [열대기상학]

Atmospheric motion in the tropics is distinguished from that in extratropics in physical and dynamical aspects. The content includes the observed characteristics of tropical atmosphere, characteristics of tropical dynamics, tropical waves, and thermodynamic aspects of tropical atmosphere. The lecture is followed by tropical phenomena of El Nino-Southern Oscillation, Intraseasonal Oscillation, Monsoon, and Tropical Cyclone. This course is intended for early graduate or undergraduate students.

EES601 Atmospheric Physics [대기물리]

Atmospheric physics is applied to study the details of weather and climate, which includes the processes of radiation, cloud physics, convection, and turbulence. Moreover, understanding of the interaction between aerosol and cloud microphysics is gaining its importance recently for its uncertain role in the global warming. The course will cover these processes and their theoretical backgrounds based upon physics.

EES602 Gas Hydrates and Climate Change [가스 하이드레이트와 기후변화]

This course presents the basic understanding and concepts of gas hydrates and their impacts on climate change. This course also covers exploration and production of natural gas hydrates, gas hydrate-based carbon dioxide capture and storage methods, and other novel technologies relating to gas hydrates.

EES603 Advanced Atmospheric Dynamics II [고급대기역학 II]

The course is composed of two main topics: i) instabilities and wave-mean flow interaction, ii) large-scale atmospheric circulation. In the first half, we cover barotropic and baroclinic instability and how the waves and instabilities affect the mean flow in which they propagate. In the second half, we are mostly concerned with the dynamics of the Hadley and Ferrel Cells and mid-latitude circulation.

EES604 Analysis and Monitoring of Organic Pollutants [유기오염물질 분석 및 모니터링]

This course will focus on multimedia sampling, extraction, cleanup and instrumental analysis for environmental monitoring of organic pollutants.

EES605 Air Pollution Management [대기오염관리]

This course covers various research fields related to air pollution including ambient air sampling, instrumental analysis, advanced monitoring, long-range transport, comprehensive management and reduction of air pollution.

EES651 Remote Sensing of the Environment [환경원격탐사]

This course investigates diverse applications of remote sensing as well as advanced digital image processing techniques for each application. This course covers understanding of various remote sensing systems (e.g. hyperspectral, LiDAR), their applications (e.g. vegetation, water) and advanced digital image processing techniques (e.g. object-based, texture-based, machine learning). Several interactive digital image processing systems (e.g., ENVI, ERDAS IMAGINE, ArcGIS, and/or MATLAB) are used by the students to analyze satellite and airborne-acquired remotely sensed image data.

EES701 Climate-Environment Modeling [기후환경 모델링]

The global climate model has been extensively used for medium-range weather forecasts, seasonal prediction, global atmospheric and oceanic reanalyses, and climate change predictions due to the increased greenhouse gases. This course introduces state-of-the-art modeling technologies that construct the model, including numerical approximations for the dynamical part, and the representations of physical parts related with sub-grid scale radiation, condensation, boundary-layer turbulence, and the treatments of land surface. The students will experiment and produce the actual simulation outputs by testing the community model opened in public.

EES801 Special Course on Climate Change [기후변화 특강]

This is a special course designed for motivating and fostering creative and interdisciplinary research models targeting on climate change. For a comprehensive understanding on the climate change, the class will review important highlights from the recent assessment reports from the Intergovernmental Panel on Climate Change (IPCC). The class will be asked to develop their own research projects during the course.

EES803 Current Topics in Carbon Dioxide Capture and Storage [이산화탄소 회수 및 저장 특론]

This course is intended to introduce recent technologies on carbon dioxide capture and storage developed and being developed for mitigating global warming.

EES810 Special Topics in Earth and Environmental Sciences Ⅰ [지구환경과학 특론 Ⅰ]

We study the current hot topics in Earth and Environmental Sciences.

EES811 Special Topics in Earth and Environmental Sciences Ⅱ [지구환경과학 특론 Ⅱ]

We study the current hot topics in Earth and Environmental Sciences.

EES812 Special Topics in Earth and Environmental Sciences Ⅲ [지구환경과학 특론 Ⅲ]

We study the current hot topics in Earth and Environmental Sciences.

EES813 Special Topics in Earth and Environmental Sciences Ⅳ [지구환경과학 특론 Ⅳ]

We study the current hot topics in Earth and Environmental Sciences.

EES814 Special Topics in Earth and Environmental Sciences Ⅴ [지구환경과학 특론 Ⅴ]

We study the current hot topics in Earth and Environmental Sciences.

EES851 Advanced Modeling Techniques for GIScience Applications GI Science [응용을 위한 고급 모델링 기법]

This course introduces advanced modeling techniques that have recently been used in GIScience applications. The techniques include machine learning approaches for both classification and regression such as decision/regression trees, random forest, support vector machines/regression, artificial neural networks, artificial immune networks, and genetic algorithms. The students will analyze GIScience data using several interactive software tools (e.g., MATLAB, ArcGIS, LP360, and ERDAS Imagine).

EES590 The Seminars1 [세미나1]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

EES591 The Seminars2 [세미나2]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

UIE501 Continuum Mechanics [연속체역학]

This course is concerned with idealization of continuous materials that can be a solid or a fluid. In lectures, we deal with tensor expression, definition of stress and strain in 3 dimensional space, and developing constitutive equations.

UIE502 Structural Dynamics [구조동역학]

The dynamic response of structures and structural components to transient loads and ground excitations is discussed for single and multi degree-of-freedom systems, including discussions for response spectrum concepts, simple inelastic structural systems, systems with distributed mass and flexibility, and fundamentals of experimental structural dynamics.

UIE503 Earthquake Resistant Design [내진설계론]

The course topics include the behavior, design, and assessment of indeterminate reinforced concrete and steel structures subjected to gravity, wind, seismic, and blast loads. Primary emphasis will be given to the introduction of available design methods for two-way slab systems, and the earthquake-resistant design of beam-column frames, slab-column frames, and shear walls.

UIE504 Low Carbon Concrete [저탄소 콘크리트 공학]

Portland cement concrete is highly economical and versatile construction building material; however, manufacture of portalnd cement is responsible for at least 5~8% of total worldwide man-made CO_2 emission because one ton of portland cement production generates 0.9 ton of CO_2. Development of new alternative binder with extremely low carbon emission to replace the portland cement in concrete production has been an urgent goal in academia and industries to build up sustainable future urban society. This course presents the state-of-art technology and research methodologies in the low carbon concrete.

UIE505 Research Methods for Urban Studies [도시연구방법론]

Quantitative analysis of data used in urban planning research. Particular emphasis on Inferential statistics through multinomial regressions, forecasting, categorical data analysis, and spatial data analysis.

UIE506 Urban form and spatial structure [도시형태 및 공간구조]

This course is about the analysis of urban form, pattern, and process. Historical exploration of how cities are patterned empirical evidence of the contemporary spatial development of metropolitan areas Industrial, residential and commercial location.

UIE507 Finite Element Methods [유한요소법]

The topics of this course include the theory and application of finite element methods stiffness matrices for triangular, quadrilateral, and isoparametric elements two- and three-dimensional elements; algorithms necessary for the assembly and solution; direct stress and plate bending problems for static, nonlinear buckling and dynamic load conditions; and displacement, hybrid, and mixed formulations.

UIE508 Land Use Planning [토지이용계획]

Integration of the structure, function, and change of ecosystems with a land use planning framework. The main subject is How land use planning accommodates human use and occupancy within ecological limits to sustain long-term natural system integrity.

UIE509 Urban Design Workshop [도시설계워크샵]

Examines urban design theory and principles, and evaluates the built environment in a studio-based setting. Working in teams, students become immersed in real work examples and propose design interventions for specific places, including socially diverse neighborhoods in small cities and major metropolitan urban centers.

UIE510 Advanced Engineering Mathematics [고급공학수학]

This course covers the basics of graduate-level applied mathematics for students majoring in engineering. Topics include complex variables, integral transformations, and partial differential equations.

UIE601 Prestressed Concrete [프리스트레스트 콘크리트]

This course discusses the strength, behavior, and design of prestressed concrete members and structures subjected to flexure, shear, and torsion, with special emphasis on pre-tensioned, precast construction. Unbonded post-tensioned members and composite prestressed beams are also introduced. The course materials also cover the evaluation of prestress losses, short-term and long-term deflections, bond between strand and concrete, and anchorage zone cracking and reinforcement.

UIE602 Crack Analysis in Concrete [콘크리트 균열해석]

Concrete structures are full of cracks. Their failure involves stable growth of large cracking zones and the formation of large fractures before the maximum load is reached. This course reviews the mechanism and analytical techniques for the cracking, which includes fracture mechanics of concrete and nonlinear mechanics of reinforced concrete.

UIE603 Time-Dependent Properties of Concrete [콘크리트 시간의존적 특성]

Creep refers to long-term deformation, usually for several years in the case of concrete, when a material is under constant load. Even within short time, large amount of creep is observed at early age of concrete, which sometimes causes a problem on the construction of high-rise buildings and piers. In the period, shrinkage is accompanied and affects the dimensional stability of early-age concrete. Thermal deformation due to heat and its transfer of hydration is also an important time-dependent property to be considered for the safety and serviceability of concrete structures.

UIE605 Real Estate Development and Investment [부동산 개발 및 투자]

The dynamics of real property development from the developer's perspective covering market research, government relations, site planning, financing, investment analysis, construction and project management, and marketing.

UIE701 Stability of Structures [구조안정론]

This course introduces principle theories and applications of structural stability that is essential in modern design of steel structures. A wide variety of stability problems are provided including elastic/inelastic buckling of bar and frames, torsional buckling, lateral buckling of beams, and buckling of rings, arches and thin plates.

UIE702 Nonlinear Finite Element Analysis [비선형 유한요소해석]

This course provides a comprehensive description of nonlinear finite element analysis for solid mechanics. It aimed to understand various approaches and difficulties inherent in nonlinear analysis as follows: Lagrangian and arbitrary Lagrangian-Eulerian formulation, explicit or implicit time integration methods, and handling nonlinear constitutive laws and structural stability.

UIE704 Concrete Micro-characterization [콘크리트 미세구조분석]

This course covers two promising structural concretes: fiber reinforced concrete (FRC) and geopolymer concrete. This course discusses various topics on these two materials from practical view for commercial use to in-depth research topics. All students are required to perform experimental research on these two materials using the following materials characterization techniques: X-ray diffractioin and Scaning Electron Microscope (SEM) and to turn in the research term-papers at the end of quarter.

UIE706 City and Neighborhood Revitalization [도시재개발]

Analyzes how economic, social, physical conditions of central cities can be improved through large-scale urban-planning efforts Understand the process of neighborhood revitalization and the main planning issues for the process.

UIE707 Theory of Planning [계획이론]

The logic of planning as a professional activity and Construction of methodologies for evaluating various theories of planning. Critical overview of current process theories leading students to develop a personal philosophy applicable to their work as planners.

UIE708 Planning for Housing [도시주택론]

The role of housing in urban planning supply and demand of the housing market and analysis of public policies for housing as they affect special consumer groups (the poor, the elderly, and the minorities).

UIE802 Rheology of Concrete [콘크리트 레올로지]

Concrete experience solidification from fluid. Its rheological properties before setting of concrete are critical for casting and construction of concrete structures. This course reviews fundamentals of fluid mechanics and rheology of unset concrete.

UIE803 Regional Economic Modeling [지역경제 모델링]

Examines the theories and limitations of input-output models, sources and weaknesses of the data, and validity of economic impact studies. Students are expected to complete a regional impact study with a sound knowledge of the inherent theoretical and data issues.

UIE810 Special Topics in Urban Infrastructure Engineering Ⅰ [도시기반시설공학특론 Ⅰ]

This course introduces new research topics in urban infrastructure engineering.

UIE811 Special Topics in Urban Infrastructure Engineering Ⅱ [도시기반시설공학특론 Ⅱ]

This course introduces new research topics in urban infrastructure engineering.

UIE812 Special Topics in Urban Infrastructure Engineering Ⅲ [도시기반시설공학특론 Ⅲ]

This course introduces new research topics in urban infrastructure engineering.

UIE813 Special Topics in Urban Infrastructure Engineering Ⅳ [도시기반시설공학특론 Ⅳ]

This course introduces new research topics in urban infrastructure engineering.

UIE814 Special Topics in Urban Infrastructure Engineering Ⅴ [도시기반시설공학특론 Ⅴ]

This course introduces new research topics in urban infrastructure engineering.

UIE590 Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

DME502 Structural Reliability [구조신뢰성]

The aim of this course is to offer a comprehensive review of reliability analysis methods and their applications to civil and structural engineering problems. In this course, students will learn several probabilistic approaches for structural reliability assessment including first- and second-order reliability methods, system reliability methods and sampling-based methods. As a final project, each student will be asked to model his/her own structural reliability problem and to solve it using one of the reliability analysis methods covered in this course.

DME503 Disaster Response and Recovery [재난대응 및 복구]

This course examines the theory and practice of response and recovery, including response variance and effectiveness. This course provides knowledge on immediate and long-term aspects of management of the post-impact phase of a disaster. The aim is to generate understanding of specific actions that should be taken during the post-impact stage of a disaster to facilitate its effective management.

DME504 Surface Hydrology [지표수문학]

This course is concerned with descriptive and quantitative hydrology dealing with the distribution, circulation, and storage of water on the earth's surface. Topics cover principles of hydrologic processes, advanced methods of analysis and their applications to water resource problems including the management of water resource facilities and flood control.

DME505 Disaster Mitigation and Preparedness [재난완화 및 대비]

This course discuss the variety of actions taken by individuals, households, businesses, communities, and governments to both prepare for the impact of disasters and offer realistic strategies to mitigate the adverse consequences of disasters. This course will explore hazard mitigation and preparedness procedures, programs, and planning through case studies.

DME506 Numerical Weather Prediction [수치 예보]

This course introduces the basics concept of numerical modeling for weather prediction and provides student with the relevant numerical methods (e.g., grid and spectral methods). In addition, students study how to apply numerical methods to practical researches such as weather forecast.

DME601 Disaster Planning and Policy [재난계획 및 정책]

This course provides knowledge to appreciate the need for integrating disaster risk reduction aspects in development policy, planning and implementation. The purpose is to equip students with the skills to identify the linkages between disasters and development, and understand the formulation and application of appropriate development planning policies integrating disaster risk reduction. This course includes reviews and critiques actual plans and engages students in components of effective disaster planning within and across various jurisdictions.

DME602 Earthquake Engineering [지진공학]

The first part of this course will focus on hazard analysis with emphasis on earthquake. The concepts necessary to understand, classify, and analyze an earthquake. The following concepts will be presented: the nature, power, and source of an earthquake, the wave propagation theory from the source to the site of interest, the characterization of a ground motion through different intensity measures, Probabilistic Seismic Hazard Analysis (PSHA). The second part of this course will involve earthquake design. The calculation of the demand and capacity of a structure subject to earthquake load will be studied. The common foundations at the base of each seismic design code will be explained. The different analyses available to assess the structural response of a structure will be explained: response spectrum method, pushover analysis, non-linear time history analysis.

DME603 Wind Engineering [풍공]

Earthquake is the major concern in the design of low and medium rise buildings but wind dominates the design process of tall buildings and long-span bridges. The scope of this course is to teach the fundamentals of wind engineering and the design criteria for wind load. The students will learn how to predict the wind hazard at the location of the structure given the surrounding environment and how to compute the wind load given the properties of the hazard and the shape of the structure. Phenomena such as buffeting, vortex shedding, galloping and flutter will be explained in detail. Wind is treated with an equivalent static load in low medium rise buildings but for tall building and long-span bridges dynamic analysis must be used.

DME604 Reliability of Infrastructure Systems [사회기반시설시스템의 신뢰성]

This course will present the different methods used to estimate: the vulnerability of individual components and the reliability of entire civil infrastructures systems including distributed systems and complex systems. Examples of distributed systems are highway networks, power grids, water distribution systems. Examples of complex systems are nuclear power plants, dams, and chemical plants. Special consideration will be given to event tree analysis and fault tree analysis for complex systems, and Monte Carlo simulation for distributed systems.

DME701 Disaster Theory and Practice [재난이론과 응용]

This course reviews the theoretical assumptions and foundation of disaster management from the interpersonal, small group, organization and societal levels.

DME702 Advanced Numerical Modeling for Weather [고급기상수치모델링]

This course provides students with advanced techniques of the atmospheric numerical modeling such as objective analysis, data assimilation, physics parameterizations and boundary condition improvement.

DME703 Random Vibrations [불규칙진동론]

This course introduces probabilistic methods and applications to describe structural behavior under stochastic dynamic loads. Both time and frequency domain analyses to extract meaningful information from random signals are discussed. Theoretical and computer-aided approaches for data processing and analysis are covered.

DME704 Smart Structures [스마트구조]

This course introduces the basics of smart structure technologies and their applications to civil infrastructural systems. It covers smart materials, sensors, sensing, monitoring, assessment, retrofit, and control. Theoretical and experimental studies are conducted.

DME801 Special Topics in Disaster Management Engineering Ⅰ [재난관리공학특론 I]

This course introduces new research topics in disaster management engineering.

DME802 Special Topics in Disaster Management Engineering II [재난관리공학특론 II]

This course introduces new research topics in disaster management engineering.

DME803 Special Topics in Disaster Management Engineering III [재난관리공학특론 III]

This course introduces new research topics in disaster management engineering.

DME804 Special Topics in Disaster Management Engineering IV [재난관리공학특론 IV]

This course introduces new research topics in disaster management engineering.

DME805 Special Topics in Disaster Management Engineering V [재난관리공학특론 V]

This course introduces new research topics in disaster management engineering.

DME590 Seminar [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and find-tuned achievements through the Seminars.

Department of Chemical Engineering

☐ Chemical Engineering [ACE]

Department of Chemical Engineering at UNIST is aiming to be a world-leader. Regarded as one of the finest institutions in Korea, this department provides its graduate students with a state-of-the-art research environment and facilities. We are 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 department 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. Faculty members are involved in cutting-edge research programs that encompass all areas of Chemical engineering: Nanoscience, Materials Science, Catalysis, Electronic Materials and Devices, Colloidal Science and Chemical Engineering. The graduate students and post doctoral researchers will have access to state-of-the-art facilities on campus, such as the UCRF and Chemical Sciences Facility.

☐ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's–Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

□ Curriculum ▶ Chemical Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
Required	ACE690	Research	Master's Research	석사논문연구	Value of Credit		
	ACE890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective	ACE590	Research	Seminar	세미나	1-1-0		
	ACE503	Lecture	Advanced Organic Chemistry	고급유기화학	3-3-0		Core Subject
	CHM542	Lecture	Advanced Quantum Chemistry	고급양자화학	3-3-0		Core Subject
	CHM561	Lecture	Advanced Inorganic Chemistry	고급무기화학	3-3-0		Core Subject
	ACE504	Lecture	Molecular Thermodynamics	분자열역학	3-3-0		Core Subject
	ACE505	Lecture	Advanced Transport Phenomena	고급전달현상	3-3-0		Core Subject
	CHM572	Lecture	Advanced Polymer Chemistry	고급고분자화학	3-3-0		Core Subject
	CHM581	Lecture	Advanced Materials Chemistry	고급재료화학	3-3-0		Core Subject
	CHM582	Lecture	Advanced Nanoscience and Nanotechnology	고급나노과학기술	3-3-0	O	Core Subject
	ACE601	Lecture	Advanced Process Control	고급공정제어	3-3-0		
	ACE602	Lecture	Semiconductor Processing	반도체공정	3-3-0	O	
	ACE603	Lecture	Catalysis	촉매	3-3-0		
	ACE604	Lecture	Organic Electronics Materials	유기전자재료	3-3-0	O	
	ACE605	Lecture	Statistical Mechanics and Molecular Simulation	통계역학 및 분자모사	3-3-0	O	
	ACE606	Lecture	Advanced Physics for Nanomaterials	나노재료물리	3-3-0	O	
	ACE607	Lecture	Polymer Structures and Properties	고분자구조 및 물성	3-3-0		
	ACE701	Lecture	Polymer Physics & Rheology	고분자물리 및 레올로지	3-3-0		
	ACE702	Lecture	Nanolithography	나노리소그래피	3-3-0	O	
	ACE703	Lecture	Advanced Organic Nanomaterials	고급유기나노재료	3-3-0	O	
	ACE704	Lecture	Printed Electronics	인쇄전자	3-3-0	O	
	ACE705	Lecture	Special Topics in Chemical and Energy Materials	화학 및 에너지 재료 특론	3-3-0	O	

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
	ACE801	Lecture	Special Lectures in Advanced Chemical Engineering A	최신화학공학특론 A	3-3-0		
Elective	ACE802	Lecture	Special Lectures in Advanced Chemical Engineering B	최신화학공학특론 B	3-3-0		
	ACE803	Lecture	Special Lectures in Advanced Chemical Engineering C	최신화학공학특론 C	3-3-0		
	ACE804	Lecture	Special Lectures in Advanced Chemical Engineering D	최신화학공학특론 D	3-3-0		
	ACE805	Lecture	Special Lectures in Advanced Chemical Engineering E	최신화학공학특론 E	3-3-0		
	ACE806	Lecture	Special Lectures in Advanced Chemical Engineering F	최신화학공학특론 F	3-3-0		
	ACE807	Lecture	Special Lectures in Advanced Chemical Engineering G	최신화학공학특론 G	3-3-0		
	ACE808	Lecture	Special Lectures in Advanced Chemical Engineering H	최신화학공학특론 H	3-3-0		
	ACE809	Lecture	Special Lectures in Advanced Chemical Engineering I	최신화학공학특론 I	3-3-0		
	ACE810	Lecture	Special Lectures in Advanced Chemical Engineering J	최신화학공학특론 J	3-3-0		

※ Student in combined master's-doctoral program and doctoral program must obtain grade A from at least 2 courses from Core Subjects

□ Description

ACE503 Advanced Organic Chemistry

The goal of synthetic chemistry is to construct target molecules from available starting materials and reagents in recognizing the various structural units, which are called synthons. The course includes conformational, synthetic and functional group analyses based on reterosynthetic approach.

CHM542 Advanced Quantum Chemistry

This course provides an introduction to methods of quantum mechanics, including Schrodinger equation and its solutions as applied to simple physical problems, elementary approximate methods, and scattering theory.

CHM561 Advanced Inorganic Chemistry

Experimental methods and characterization tools for coordination compounds, organometallics, quantum dot, and metal nanomaterials will be introduced. The practical application of these inorganic materials will also be introduced.

ACE504 Molecular Thermodynamics

This course offers in-depth understanding of thermodynamics based on molecular physics and statistical mechanics together with classical macroscopic thermodynamics. This combination enables us to calculate a variety of thermodynamic properties quantitatively and to systematically analyze many apparently complex thermodynamic phenomena occurring in mixtures.

ACE505 Advanced Transport Phenomena

This course provides advanced level of understanding on the transport phenomena (momentum, heat, and mass transfer) from an unified viewpoint. It covers not only the conventional macroscopic approach but also rigorous microscopic approach based on statistical mechanics, which is useful in dealing with a variety of real problems.

CHM572 Advanced Polymer Chemistry

This course will provide advanced level topics in Polymer Chemistry including an introduction to Polymer Chemistry and the Physical Chemistry of Polymers. The course is designed to deliver graduate students a comprehensive understanding of the Chemistry of polymer synthesis and the physical behaviors of polymers. Topics will cover (i) Chemistry of polymers, (ii) physical properties of polymers, (iii) solution thermodynamics of polymers, and (iv) advanced topics in polymer Chemistry and physical Chemistry of polymers.

CHM581 Advanced Materials Chemistry

This course is intended primarily as an introduction course to materials and solid state Chemistry for graduate students and advanced undergraduate students. The objective is to understand solids from a Chemical perspective and introduce general solid state synthesis methodologies and characterization techniques. Topics covered will include structure and structure determination of crystalline solids; free electron model for metals; electronic band structure; chemical bonding in solids; and structure-property relationships.

CHM582 Advanced Nanoscience and Nanotechnology

This course presents a review of recent scientific papers in modern nanoscience and nanotechnology, and introduces principles of sciences and technologies appearing in the review. This course deals with advanced subjects.

ACE601 Advanced Process Control

This course provides in-depth understanding of 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 workable, economical, and safe chemical processes and products.

ACE602 Semiconductor Processing

This course offers the understanding of the semiconductor chemical processes and the basis required for designing semiconductor chemical processes. This course covers oxidation, diffusion, ion implantation, chemical vapor deposition, photolithography, metallization, and all of the silicon processing.

ACE603 Catalysis

This course is intended primarily as an introduction course to catalysis for graduate students. The objective of this course is to understand basic principles of catalytic phenomena. Topics covered include preparation and characterizations of catalysts, correlation between the structure of catalysts and their activity, catalytic reaction kinetics and mechanism, and properties and working principles of metal, metal oxides, acid-base, and homogeneous catalysts.

ACE604 Organic Electronics Materials

The course covers molecular design and synthesis, charge generation and charge transport mechanisms, and the structure-property relationship of organic electronic materials including organic semiconductors, polymeric electronic materials, carbon nanomaterials, dielectrics, and dopants. In addition, this course aims at an in-depth understanding of the fabrication methods, operation principles, performance optimization approaches of organic electronic devices such as organic field-effect transistors (OFETs), organic light-emitting diodes (OLEDs), organic solar cells, sensors, and nano-devices.

ACE605 Statistical Mechanics and Molecular Simulation

This course focuses on the fundamentals of classical/quantum statistical mechanics and their applications in a wide variety of research subjects. In this course, we also deal with the basics of molecular simulations in conjunction with statistical mechanics, followed by their practical applications to physical systems and phenomena. Basic knowledge of thermodynamics is prerequisite.

ACE606 Advanced Physics for Nanomaterials

This course is about the electronic properties of nano-materials and contains lectures about scattering, transport in metals, phonons and superconductivity. The goal of the course is twofold: to present modern concepts of the electronic properties of the nano-materials, and to develop the ability to understand scientific papers.

ACE607 Polymer Structures and Properties

This course will look into the microstructures and properties of polymeric materials, thereby aiming at an in-depth understanding of the structure-property relationship. This class is designed to deliver basic knowledge and skills for molecular design and the synthesis of novel polymeric materials with desired physical or chemical properties. In addition, theoretical methodologies and experimental analysis tools for the investigation of macromolecular structures and their properties will also be introduced.

ACE701 Polymer Physics and Rheology

This course covers the general physical behaviors of polymeric materials under equilibrium and nonequilibrium (flowing) conditions, with a particular emphasis on rheological properties of polymers. Statistical analysis will also be taken into account in order to get insight into the structural and thermodynamical properties intrinsic to polymers. Basis knowledge of transport phenomena is prerequisite.

ACE702 Nanolithography

This course offers the understanding of the basic principles in top-down methods in semiconductor processing and also bottom-up methods in manipulating nanoparticles, nanotubes, and nanowires for the fabrication of nanostructures and nanoscale patterns.

ACE703 Advanced Organic Nanomaterials

This course is designed to introduce fabrication methods of nanostructured functional organic materials and their applications. Fabrication methods of organic nanomaterials with various morphologies based on self-assembly and template synthesis of small molecules and polymers are covered, and their state-of-the-art applications in optoelectronic devices, energy devices, drug delivery, and biomimic materials are also introduced.

ACE704 Printed Electronics

Electronic device manufacturing is poised to undergo a renaissance through the utilization of relatively low-cost, high-speed printing technologies. Over the last several years, the development of new materials and technologies such as printable organic semiconductors, inkjet systems and lower cost, robust flexible substrates, have made the manufacture of electronic and display devices by high speed printing in commercial environments possible. This revolutionary shift in A1 manufacturing philosophy will enable significant cost reductions in existing products, will allow manufacturers to expand current products into new markets and will also foster the development of entirely new, products and technologies such as smart packaging solutions, flexible displays and RFID tags. This course covers the state-of-the-art printing technologies, materials considerations and implementation challenges that are shaping the future of the electronics industry. The program offers the opportunity to obtain an expert start in the Printed Electronics field, to get an update, or to open up exciting new opportunities.

ACE705 Special Topics in Chemical and Energy Materials

This course will introduce recent development of materials for applications in chemical and energy engineering. The students will learn the fundamental chemical and physical properties of polymers and inorganic materials required in applications in green energy process, catalysis, batteries, solar cells, and electronic devices.

ACE801-810 Special Lectures in Chemical Engineering A-J

This course is designed to introduce the current trends and the state-of the-art states of nanotechnologies, biotechnologies and Chemistry-related technologies. To keep the flexibility of the course, the topics and the instructors will be changed every semesters.

ACE590 The Seminars

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

ACE690 Master's Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

ACE890 Doctoral Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Energy Engineering

□ Energy Engineering [ENE]

Department of Energy Engineering provides exciting and unique undergraduate and graduate programs that deal with energy production, energy conversion, energy storage, and energy efficiency, alternative energy technologies from a basic concept to practical technology. We combine courses from chemistry, electrochemistry, polymer, ceramics, physics, and materials engineering to create a strong knowledge base essential to success in energy-related areas. Students have the opportunity to take courses and research focused on specific energy research subjects that includes solar cell, fuel cell, battery, and other energy-related devices and materials. Along with research activities in our department, our students will be well-prepared for career focused on energy science and engineering and creatively apply their knowledge to confront the global challenges of energy supply and demand.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Energy Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre-requisite	Convergence
Required	ENE590	Research	The Seminars	세미나	1-1-0		
Required	ENE690	Lecture	Master's Research	석사논문연구	Value of Credit		
Required	ENE600	Research	Research Trends in Green Energy I	친환경에너지연구동향 I	3-3-0		
Required	ENE890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective (Ph.D.)	ENE719	Lecture	Special topics on Energy Conversion and Storage I	에너지 변환 및 저장 I	3-3-0		
Elective (Ph.D.)	ENE729	Lecture	Special topics on Energy Conversion and Storage II	에너지 변환 및 저장 II	3-3-0		
Elective	ENE619	Lecture	Energy Engineering I	에너지공학 특론 I	3-3-0		
Elective	ENE629	Lecture	Energy Engineering II	에너지공학 특론 II	3-3-0		
Elective	ENE639	Lecture	Energy Engineering III	에너지공학 특론 III	3-3-0		
Elective	ENE790	Research	Research Trends in Green Energy II	친환경에너지연구동향 II	2-2-0		
Elective	BST511	Lecture	Special Topics on Solid State Chemistry	고체화학특론	3-3-0		
Elective	BST512	Lecture	Nanomaterials for Lithium-ion Batteries	이차전지 나노재료	3-3-0		O
Elective	BST513	Lecture	Renewable Energy System and Design	친환경 에너지 시스템과 디자인	3-3-0		O
Elective	BST521	Lecture	X-ray Powder Diffraction	X-선 분말 결정	3-3-0		
Elective	BST522	Lecture	Nanostructured Electrodes for Lithium-ion Batteries I	리튬이온전지를 위한 전극물질I	3-3-0		
Elective	BST523	Lecture	Surface and Thin Film Analysis	표면 및 박막 분석	3-3-0		
Elective	BST531	Lecture	Electrodes for Lithium-ion Batteries II	리튬이온전지를 위한 전극물질II	3-3-0		
Elective	BST532	Lecture	Electrolytes for Lithium-ion Natteries	전해액	3-3-0		
Elective	BST533	Lecture	Applied Electrochemistry	응용전기화학	3-3-0		
Elective	BST534	Lecture	Special Topics on Battery Science and Technology I	배터리과학 및 기술 특론 I	3-3-0		
Elective	BST535	Lecture	Special Topics on Battery Science and Technology II	배터리과학 및 기술 특론 II	3-3-0		
Elective	BST536	Lecture	Special Topics on Battery Science and Technology III	배터리과학 및 기술 특론 III	3-3-0		
Elective	BST537	Lecture	Special Topics on Battery Science and Technology IV	배터리과학 및 기술 특론 IV	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Pre-requisite	Convergence
Elective	BST538	Lecture	Special Topics on Battery Science and Technology V	배터리과학 및 기술 특론 V	3-3-0		
Elective	ECS511	Lecture	Solid State Chemistry	고급 고체화학	3-3-0		
Elective	ECS512	Lecture	Advanced Electrochemistry	고급 전기화학	3-3-0		
Elective	ECS513	Lecture	Special Topics on Solar Cells	태양전지 특론	3-3-0		O
Elective	ECS514	Lecture	Advanced Inorganic Chemistry	고급 무기화학	3-3-0		
Elective	ECS522	Lecture	Electrochemical Energy Conversion & Storage	전기화학적 에너지변환 및 저장	3-3-0		O
Elective	ECS524	Lecture	Special Topics on Fuel Cells	연료전지 특론	3-3-0		O
Elective	ECS526	Lecture	Advanced Organic Spectroscopy	고급 유기분광학	3-3-0		
Elective	ECS527	Lecture	Organic Electronics	유기 일렉트로닉스	3-3-0		O
Elective	ECS531	Lecture	Advanced Organic Chemistry	고급유기화학	3-3-0		
Elective	ECS532	Lecture	Advance Materials Analysis	고급재료분석	3-3-0		
Elective	ECS581	Lecture	Special Topics on Energy Materials I	에너지재료 특론 I	3-3-0		
Elective	ECS582	Lecture	Special Topics on Energy Materials II	에너지재료 특론 I	3-3-0		
Elective	ECS583	Lecture	Special Topics on Energy Materials III	에너지재료 특론 II	3-3-0		
Elective	ECS584	Lecture	Special Topics on Energy Materials IV	에너지재료 특론 IV	3-3-0		
Elective	ECS585	Lecture	Special Topics on Energy Materials V	에너지재료 특론 V	3-3-0		
Elective	ECS611	Lecture	Advanced Polymer Materials	고급 고분자 재료	3-3-0		O
Elective	ECS612	Lecture	Nanostructures and Nanomaterials	나노공학	3-3-0		
Elective	ECS613	Lecture	Advanced Quantum Physics I	고급양자물리학 I	3-3-0		
Elective	ECS614	Lecture	Nanochemistry	나노화학	3-3-0		
Elective	ECS615	Lecture	Carbon-based Nanomaterials	탄소기반 나노재료 특론	3-3-0		
Elective	ECS621	Lecture	Fundamental of the Advanced Fuel Cells	고급 연료전지	3-3-0		
Elective	ECS622	Lecture	Crystallography	결정학	3-3-0		
Elective	ECS623	Lecture	Advanced Quantum Physics II	고급양자물리학 II	3-3-0		
Elective	ECS631	Lecture	Materials for Organic Electronics	유기전자재료	3-3-0		O
Elective	ECS632	Lecture	Nanomaterials for Energy Storage	에너지 저장용 나노재료	3-3-0		O
Elective	ECS633	Lecture	Special Topics on Electronic Materials	전자재료 특론	3-3-0		O
Elective	ECS634	Lecture	Lithography	리소그래피 특론	3-3-0		O
Elective	ECS635	Lecture	Nano thin films	나노박막 특론	3-3-0		

☐ Description

ENE590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

ENE600 Research Trends in Green Energy I [친환경에너지연구동향 I]

This course is designed to investigate recent trends in green energy fields and provide discussions with other students, researchers, and professors.

ENE619 Energy engineering I [에너지공학 특론 I]

In Li-ion batteries, irreversible reactions are dependent upon the species of the surface, and thus, different surface of materials induces different irreversible reactions, resulting in different battery performances. Therefore, in this point of view, it is necessary to attain a comprehensive understanding of the roles of surface chemistry because it is a very important factor in improving the performance of lithium ion batteries. This course thus provide the various roles and fundamentals of surface chemistry in cathode and anode materials for lithium ion batteries.

ENE629 Energy engineering II [에너지공학 특론 II]

This course is designed to investigate recent trends in energy engineering fields and provide discussions with other students, researchers, and professors. Through this course, the students will have opportunities to extend his/her knowledge in the area of energy engineering such as rechargeable batteries, solar cells, fuel cells as well as energy materials.

ENE639 Energy engineering III [에너지공학 특론 III]

This course covers the basic knowledges related to solar cells, batteries, fuel cells. In addition, it includes discussion sections with students and professor for some special topics. From this course, the students will extend their knowledge concerning energy engineering.

ENE690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

ENE719 Special topics on energy conversion and storage I [에너지변환 및 저장 I]

This course helps you investigate recent trends in energy conversion research and its storage. The conversion includes solar cells, hydrogen generation, fuel cells, and the storage includes secondary ion batteries and hydrogen storage. Brief introduction and future prospect will be discussed.

ENE729 Special topics on energy conversion and storage II [에너지변환 및 저장 II]

This course is designed as a extended subject of special topics on energy conversion and storage I. Thus, this course helps you build your individual research skills and rounded expertise in energy conversion and storage.

ENE790 Research Trends in Green Energy II [친환경에너지연구동향 II]

This course is designed to investigate recent trends in green energy fields and provide discussions with other students, researchers, and professors. Through this course, the students will have opportunities to extend his/her knowledge in green energy fields. Also students and professors can exchange their own ideas.

ENE890 Doctoral Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

BST511 Special topics on Solid State Chemistry [고체화학특론]

This course explores the basic principles of solid state chemistry and its application to engineering systems. 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 covered include crystal structure, electrical & ionic conductivity, electrochemistry, chemical kinetics, diffusion, synthesis method, and phase diagrams. Examples are drawn from energy generation and storage devices such as batteries, fuel cells, and superconductors.

BST512 Nanomaterials for lithium-ion batteries [이차전지 나노재료]

This course will investigate the selected topics from areas of current research in materials chemistry. Particularly, the advanced nanotechnologies in electrode materials and battery systems of the Li-ion cells, will be discussed. Topics include: Nanoparticles synthesis, sol-gel process, mesoporous materials, advanced concepts in materials chemistry, and recent technology updates for anode and cathode materials in terms of energy density and safety.

BST513 Renewable Energy System and Design [친환경 에너지 시스템과 디자인]

This course is designed to introduce the system and design of energy conversion and storage devices for renewable energy sources. Students will first learn the fundamental principles of the various renewable energy options including kinetic, solar, and chemicals. 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. After taking this course, the students will be familiar with the economic and societal impact of renewable energy systems, and be able to participate in the design or selection of renewable energy systems.

BST521 X-ray powder diffraction [X-선 분말 결정]

This course covers the fundamentals of solid state chemistry including crystallography and principles of XRD analysis to characterize the crystal structure of powders, at the beginning of the semester. A training course for the Rietveld method using the GSAS program will follow.

BST522 Nanostructured electrodes for lithium-ion batteries I [리튬이온전지를 위한 전극물질 I]

This course will cover the latest developments, challenges, and perspectives of nanostructured electrodes for lithium-ion batteries. Compared to bulk electrode materials, the synthesis, electrochemical properties, advantages/disadvantages of nanostructured electrodes will be described. Moreover, the outlook for future-generation batteries will be discussed.

BST523 Surface and thin film analysis [표면 및 박막 분석]

Materials analysis is based on the measurement of particles (e.g. electrons, ions) and radiation (e.g. X-ray) that emerge from a solid that is irradiated by photons, electrons, or heavy particles. This class focuses on the physics underlying the techniques used to analyze the surface region of materials. The various techniques including RBS, XPS, AES, XRD, XAS (XANES & EXAFS), and etc will be covered.

BST531 Nanostructured electrodes for lithium-ion batteries II [리튬이온전지를 위한 전극물질 II]

This course will cover the history of electrode materials for lithium batteries including lithium-ion batteries and lithium-air batteries. Primary batteries, various secondary batteries, and their applications will be discussed. In addition, the latest development and perspectives of these electrode materials will be described.

BST532 Electrolytes for lithium-ion batteries [전해액]

This course is designed for students who plan to major in advanced organic materials for energy storage devices. In this lecture, chemical and electrochemical properties of electrolytes including important principles and facts will be covered. This course deals with the recent development of organic materials including liquid/polymer electrolytes and binders for electrodes, and interfacial phenomena between electrodes and electrolytes. Also, it covers synthesis of advanced organic materials and instrumental analysis.

BST533 Applied electrochemistry [응용전기화학]

This course will cover various applications in electrochemistry. After briefing on basic concepts of fundamentals of electrochemistry, various electrochemical methods in energy storage/conversion devices will be discussed. Papers will be used for in-depth study in the applications.

BST534-538 Special Topics on Battery Science and Technology I-V [배터리과학 및 기술 특론 I-V]

In this lecture, we will be exploring advanced topics in Battery Science and Technology research: Next generation rechargeable batteries, Membrane technology, Electrolytes, all solid-state batteries, Nanostructured electrode materials.

ECS511 Solid State Chemistry [고급 고체화학]

In this lecture, we will be exploring physical, chemical and electrical properties of many major scientific advances in inorganic materials, including a high temperature superconductor (YBCO), a new form of carbon, C60 (fullerenes), the commercial development of rechargeable batteries, and fuel cells. We will also examine their application to real engineering systems.

ECS512 Advanced Electrochemistry [고급 전기화학]

This course covers the fundamentals of electrochemistry including thermodynamics and electrode kinetics, as well as mathematical techniques necessary to tackle electrochemical problems, at the beginning of the semester. Detailed discussions of various electrochemical techniques and applications are then followed.

ECS513 Special Topics on Solar Cells [태양전지 특론]

This course provides a fundamental understanding of the functioning of solar cells. The discussion includes the solar cell structures, various types of cells, their theoretic parts, and analysis tools. In addition to the various kinds of solar cells, PCS system and markets for solar cells will be provided. Presentations on each type of solar cell is required for the course.

ECS514 Advanced Inorganic Chemistry [고급 무기화학]

Experimental methods and characterization tools for coordination compounds, organometallics, quantum dot, and metal nanomaterials will be introduced. The practical application of these inorganic materials will also be introduced.

ECS522 Electrochemical Energy Conversion & Storage [전기화학적 에너지변환 및 저장]

This course (EECS) covers from basic electrochemistry to electrochemistry-based energy devices. Based on the understanding of electrochemistry, graduates and seniors learn the principles and the state-of-the-art technologies of energy devices including batteries, fuel cells, electrochemical capacitors and biofuel cells.

ECS524 Special Topics on Fuel Cells [연료전지 특론]

This class covers the various topics for fuel cells. It focuses on thermodynamics, kinetics, mass transport, modeling and measurement of cell performance.

ECS526 Advanced Organic Spectroscopy [고급 유기분광학]

This course deals with the principle and application of modern spectroscopy by organic chemists. It focuses on the use of instrumental methods in assigning structures with organic molecules, which covers ultra-violet/visible (UV-Vis), infrared(IR), nuclear magnetic resonance (NMR) specroscopy, and mass (MS) spectometry. Both the basic theory and practical applications of these methods are discussed.

ECS527 Organic Electronics [유기 일렉트로닉스]

This course will cover the basic concepts, mechanisms, and special issues in organic electronics. Based on understanding of the basic properties of inorganic semiconductors, this course will focus on the applications using organic semiconductors such as organic light-emitting diodes, organic solar cells, and organic field-effect transistors.

ECS531 Advanced Organic Chemistry [고급 유기화학]

This course will introduce the advanced organic reactions used for the organic synthesis, including general alkylation, carbonyl addition/condensation reactions, nucleophilic substitution for functional group interconversion, electrophilic addition, redox reactions, cycloadditions, and organometallic reactions. We will also cover about the physical organic chemistry to probe the mechanism of the related reactions. The general objective of this course is to provide the solid foundation of organic synthesis and to nurture the integration of organic synthesis knowledge into the respective research fields.

ECS532 Advanced Materials Analysis [고급 재료분석]

This course covers the principles of analytical instruments which are needed in the characterization of organic and inorganic 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).

ECS611 Advanced Polymer Materials [고급 고분자재료]

Polymers are very important materials for daily life to advanced technologies. This course will briefly deal polymer concepts for students who have not taken polymer course(s) before. Then, specialty polymers for opto-electronic and energy conversion and storage applications are discussed in details.

ECS612 Nanostructures and Nanomaterials [나노공학]

This course deals with small structures or small sized materials. A nanometer is one billionth of a meter. Small features permit more functionality in a given space. Nanotechnology is nanostructure design, synthesis, and applications. During the class, synthesis, analysis, and applications of nanostructured materials will be covered.

ECS613 Advanced Quantum Physics I [고급양자물리학 I]

This course covers quantum mechanics at the beginning graduate level. Undergraduate physics courses, including electro-magnetism, quantum mechanics are prerequisite for this course. Theoretical foundations of quantum mechanics are gently introduced in comparison with classical physics. Mathematical tools for Hamiltonian mechanics also covered in relation with the structure of quantum mechanics. All students who wants to take the course should consult with the Lecture for the appropriateness of the course content.

ECS614 Nanochemistry [나노화학]

This course presents concepts of nanochemistry in various nanosciences and nanotechnologies. Topics include synthetic methods of nanomaterials, fabrication methods of nanostructures, and analytical methods of nanostructured materials. This course is designed for graduate students with backgrounds in chemistry, physics, and material science.

ECS615 Carbon-based Nanomaterials [탄소기반 나노재료 특론]

Carbon-based nanomaterials have attracted significant attention due to those unique and tunable properties. This course will introduce recent advances in carbon-based nanomaterials such as fullerene, carbon nanotube, and graphene, as well as carbon-based nanodevices.

ECS621 Fundamental of the Advanced Fuel Cells [고급 연료전지]

This lecture will provide the knowledge of components, characterization, and application in fuel cells, such as proton exchange membrane (PEM), Phosphoric fuel cells, Molten Carbonate fuel cells, and Solid Oxide fuel cells. It also delivers the scientific information for their characterizations via ceramic engineering and solid state electrochemistry.

ECS622 Crystallography [결정학]

The basic group theory which deals with molecular structure and symmetry will be discussed. The properties of crystals, X-rays and the interaction between the crystal and X-ray will be covered. The theory of the molecular structure determination by X-ray diffraction will be discussed and the single-crystal structure determination will be practiced using a real data set obtained via a diffratometer.

ECS623 Advanced Quantum Physics II [고급양자물리학 II]

This course aims to give more practical experience with Quantum Mechanics. Concept of angular momentum, identical particle, perturbation theory, and scattering theory will be introduced. At the later part of the course, the relativistic Quantum mechanics is shortly introduced. Theories of solid states physics and electronic structures are also introduced. All students who wants to take the course should consult with the Lecture for the appropriateness of the course content.

ECS631 Materials for Organic Electronics [유기전자재료]

This course will cover the molecular design and engineering of organic materials for electronic, optical, and electrochemical applications such as organic light-emitting diodes (OLED), organic field-effect transistors (OFETs), and organic solar cell (OSC). The general routes for their synthesis will also be introduced.

ECS632 Nanomaterials for Energy Storage [에너지 저장용 나노재료]

This course will deliver the synthetic methods and characterization of nanomaterials for energy storage. Using different synthetic methods, the dimension of energy storage materials can be varied and their storage capabilities are also changed. Thus, this course will focus on the synthetic methods of the storage materials, and discuss about the optimization of the synthetic conditions of the materials using various methods.

ECS633 Special Topics on Electronic Materials [전자재료 특론]

This course will deliver the principle and applications of electronic materials. This is an advanced course that covers the overall principles of the materials which take part in modern industries. This course consists of two parts; one is to understand the basic principles of the materials, based on the atomic bonding nature. The other is to provide the deep knowledge on the device applications of electronic materials, such as semiconductors, electrochemical materials (Li-ion, solar, fuel cells), and magnetic materials. The other part is to review the synthetic methods of the electronic materials to help understand recent advances in electronic materials.

ECS634 Lithography [리소그래피 특론]

Lithography is one of most important tools towards energy-related materials. This course covers the fundamental theory of several lithography techniques and the applications of the structures fabricated from each technique.

ECS635 Nano Thin Films [나노박막 특론]

This course aims to provide the basic principles and applications of nanoscale thin films composed of inorganic and organic materials. In addition, understanding the relevant characterization tools will be discussed in detail. This course is designed for graduate students with backgrounds in chemistry, physics, and material science.

ECS581-585 Special Topics on Energy Materials I-V [에너지재료 특론 I-V]

In this lecture, we will be exploring recent trends in Energy Conversion and Storage Research. The challenges and state-of-the-art technologies on Energy Materials will be discussed.

Department of Physics

□ Physics [물리학과]

The department of physics aims at being at the forefront of both exploring fundamental scientific aspects and establishing the links to various real-world applications of the central areas of modern physics. The main research areas include theoretical physics and cosmology, plasma and beam physics, condensed matter physics, atomic, molecular and opticla physics and biophysics. More details for these research areas can be found below.

• Theoretical Particle Physics and Cosmology

Diverse topics in theoretical high energy physics and cosmology, including unified field theory, gauge theory, gravitation, and early universe physics, are studied extensively. Also, compressive sensing, a revolutionary theory of signal processing, is explored as an interdisciplinary research topic boosting collaborations with other schools such as electrical & computer engineering and nano-bioscience & chemical engineering.

• Theoretical Condensed Matter Physics

Theoretical condensed matter physics basically seeks to use the well-established laws of microscopic physics to predict the collective properties of very large numbers of electrons, atoms or molecules. Particular interests are on electronic and mechanical properties of materials in 3D bulk and reduced dimensions (2D crystals, nanowires, and quantum dots). Another big interests are given to soft condensed matters, mainly polymers, and their interactions with surfaces and nanoscale material systems such as nanoparticles and nanowires.

• Experimental Condensed Matter and Device Physics

In experimental condensed matter and device physics, we are basically interested in developing and characterizing various material systems and the actual devices based on those materials, particularly in electronic, optoelectronic, and photovoltaic applications. In the field of organic materials, the research topics include development of polymer solar cell, polymer light emitting diode, polymer battery, and inorganic-organic hybrid devices. For inorganic materials, the research interests are in Si-based nano CMOS, TCAD-based device modeling, metal oxide thin films for future nonvolatile memory devices, wide bandgap semiconductors for power devices and optoelectronic devices, and new material systems exhibiting novel quantum transport properties such as semiconductor quantum wires/dots and graphene.

• Biophysics & Physical Biology

The main goal of biophysics is to understand the emergent properties of various levels of biological systems, ranging from single molecules to cells, tissues, and eventually to ecological systems in terms of the interactions and the information processing among their constituents. We are interested in the genome-wide picture of genetic regulation, protein-protein interaction, and cellular metabolism as well as the detailed molecular machinery at the individual molecule level. We are also interested in developing methods of non-equilibrium statistical mechanics that are essential for analyzing chemically-driven subcellular processes. Our expertise in experimental biophysics covers tumor microenvironments imaging, susceptibility contrast MRI, dynamic nuclear polarization, and compressive sensing for dynamic contrast enhanced MRI.

• Plasma and Beam Physics

Our study of plasma and beam physics focuses on the properties of plasma and beam as classical, collective, many-body systems, and their interactions with electromagnetic waves. The active research topics include laser-plasma modeling, plasma-based THz generation, THz absorber/filter, high-power microwave sources for fusion research.

• Atomic, Molecular, and Optical Physics

One research topic in atomic, molecular, and optical physics is dedicated to generating and understanding quantum systems with strong interactions and correlations. Specifically, the many-body aspects of the system with many atoms interacting and forming new quantum phases of matter and the entanglement and correlation of few particles (atoms and photons) are explored, which are the foundations of quantum information with cold atoms. Another research topic is to understand extreme-subwavelength optical phenomena occurring in nanoscale system.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's–Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Physics

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Required	PHY501	Lecture	Classical Mechanics I	고전역학 I	3-3-0		
Required	PHY503	Lecture	Electrodynamics I	전기역학 I	3-3-0		
Required	PHY505	Lecture	Quantum Mechanics I	양자역학 I	3-3-0		
Required	PHY507	Lecture	Statistical Mechanics	통계역학	3-3-0		
Elective	PHY500	Lecture	Advanced Mathematical Physics	고급수리물리	3-3-0		
Elective	PHY502	Lecture	Classical Mechanics II	고전역학 II	3-3-0		
Elective	PHY504	Lecture	Electrodynamics II	전기역학 II	3-3-0		
Elective	PHY506	Lecture	Quantum Mechanics II	양자역학 II	3-3-0		
Elective	PHY511	Lecture	Elementary High Energy Physics	고에너지물리개론	3-3-0		
Elective	PHY521	Lecture	Condensed Matter Physics	응집물질물리	3-3-0		
Elective	PHY541	Lecture	Computational Physics	전산물리	3-3-0		
Elective	PHY551	Lecture	Introductory Astrophysics	천체물리 개론	3-3-0		
Elective	PHY552	Lecture	General Relativity and Cosmology	일반상대론 및 우주론	3-3-0		
Elective	PHY561	Lecture	Plasma Physics	플라즈마 물리	3-3-0	EE231, PHY203, PHY204	
Elective	PHY681	Lecture	Special Topics in Condensed Matter Physics	고체물리 특론	3-3-0		
Elective	PHY682	Lecture	Special Topics in Plasma and Beam Physics	플라즈마 및 빔물리 특론	3-3-0		
Elective	PHY683	Lecture	Special Topics in Biophysics	생체물리 특론	3-3-0		
Elective	PHY684	Lecture	Special Topics in Theoretical Physics	이론물리 특론	3-3-0		
Elective	PHY685	Lecture	Special Topics in Astrophysics and Cosmology	천체물리 및 우주론 특론	3-3-0		
Elective	PHY686	Lecture	Special Topics in High Energy Physics	고에너지물리 특론	3-3-0		
Elective	PHY687	Lecture	Special Topics in Atomic, Molecular and Optical Physics	원자분자광물리 특론	3-3-0		
Elective	PHY688	Lecture	Special Topics in Computational Physics	전산물리 특론	3-3-0		
Elective	PHY711	Lecture	Quantum Field Theory I	양자장론 I	3-3-0		
Elective	PHY712	Lecture	Quantum Field Theory II	양자장론 II	3-3-0		
Elective	PHY721	Lecture	Advanced Condensed Matter Physics	고급응집물질물리	3-3-0		
Elective	PHY723	Lecture	Interface Physics of Electronic Devices	전자소자 계면물리	3-3-0	EE331	O
Elective	PHY731	Lecture	Phase Transition and Critical Phenomena	상전이와 임계현상	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Prerequisite	Convergence
Elective	PHY761	Lecture	Physics of Vacuum Electron Devices	진공 전자소자 물리	3-3-0		O
Elective	PHY762	Lecture	Advanced Plasma Physics	고급 플라즈마 물리	3-3-0		
Elective	PHY763	Lecture	Laser-Plasma Physics	레이저-플라즈마 물리	3-3-0		
Elective	PHY765	Lecture	Nuclear Fusion Engineering	핵융합 공학	3-3-0		O
Elective	PHY881	Lecture	Advanced Topics in Theoretical Physics	이론물리 고등논제	3-3-0		
Elective	PHY882	Lecture	Advanced Topics in Experimental Physics	실험물리 고등논제			
Elective	ECE772	Lecture	Nanoscale Electronic Devices	나노전자소자	3-3-0		
Elective	MSE580	Lecture	Polymer Structure and Properties	고분자구조및 물성	3-3-0		
Elective	MSE631	Lecture	Electronic Porperties of Materials	재료의 전자기적 성질	3-3-0		
Elective	MSE731	Lecture	Advanced Magnetic Materials	자성재료 특론	3-3-0		
Required	PHY590	Research	Seminar	세미나	1-1-0		
Required	PHY690	Research	Master Research	석사논문연구	Value of Credit		
Required	PHY890	Research	Doctoral Research	박사논문연구	Value of Credit		

☐ Description

PHY500 Advanced Mathematical Phycis [고급수리물리]

This course covers mathematical methods for application to problems in physics or engineering. General overview of differential equation, linear algebra, complex variable, some examples for special functions, and variational method will be introduced. Undergraduate courses of the electromagnetism and quantum mechanics are recommended prerequisite but not mandatory.

PHY501 Classical Mechanics I [고전역학 I]

This course covers various aspects of the Newtonian mechanics using high level mathematical techniques. The subjects include kinematics, angular motion, gravity, oscillations and motions of rigid bodies. Formalism using Lagrangians and Hamiltonians are introduced via calculus of variation, and its connection to quantum mechanics and relativity is discussed.

PHY502 Classical Mechanics II [고전역학 II]

This course is continuation of Classical Mechanics I, intended to deepen the basic concepts of Lagrangian and Hamiltonian formulations for continuous systems and fields. Canonical transformation and Hamiltonian-Jacobi theory are also introduced. Relativistic systems are also discussed in depth.

PHY503 Electrodynamics I [전기역학 I]

In this course we provide the student with the basic knowledge of electrodynamics, which are necessary to understand the advanced electrodynamics. The electrostatics, magnetostatics, boundary value problems, Maxwell equations, and wave propagations are covered.

PHY504 Electrodynamics II [전기역학 II]

Students study the radiation by charged particles and its interaction with materials. The Lienard-Wiechert Potential, Synchrotron radiation, Reflection, Transmission, Absorption of the electromagnetic wave to materials are covered.

PHY505 Quantum Mechanics I [양자역학 I]

This course is intended to improve our understanding of the basic principles and theoretical schemes of quantum mechanics by revisiting the topics covered in undergraduate quantum mechanics with more systematic and advanced mathematical formalism. The basic assumptions, Dirac notation, Hilbert space, Schrodinger equation, harmonic oscillator, angular momentum, spin and identical particles will be discussed.

PHY506 Quantum Mechanics II [양자역학 II]

This course deals with perturbation theory, variational method, scattering theory, quantum statistical mechanics, etc. which are essential to explain many physical phenomena occurring actually in nature.

PHY507 Statistical Mechanics [통계역학]

This course provides the fundamental principles of many-body systems in terms of their physical properties such as heat, free energy, entropy, etc. The power of statistical mechanics lies on its ability to predict statistical behavior of many molecules and the corresponding macroscopic material property changes, including phase transition between gas, liquid, and solid.

PHY511 Elementary High Energy Physics [고에너지물리개론]

This course introduces various mathematical tools and theoretical frameworks for understanding modern high energy physics and field theories. The current status of standard model including Quantum Electrodynamics, Strong and electroweak interactions, group theory, symmetry are introduced and students will learn a basic method of performing Feynman integrals.

PHY521 Condensed Matter Physics [응집물질물리]

This course introduces the most important concepts of modern condensed matter physics at the beginning graduate level. It aims to provide a range of solid-state phenomena that can be understood within an independent particle description. Topics include crystal structure, lattice dynamics, reciprocal space, phonons, solid-state thermodynamics, free and nearly free electron models, kinetic theory and transport, energy band theory, semiconductors physics and devices.

PHY541 Computational Physics [전산물리]

The goal of this course is to let the students taste diverse contemporary methodologies used in solving physical problems by computers. In the first part of the course, basic computational techniques of root-finding, spectral analysis, differential equations, etc. are covered. In the second part, various numerical methods used in on-going research problems are explained on an introductory level. The subjects will be some from particle-in-cell simulations, molecular dynamics simulations, Monte-Carlo methods, the first principle calculations, fluid dynamics, genetic algorithms, Boltzmann equations, numerical renormalization, and others depending on the lecturer's choices.

PHY551 Introductory Astrophysics [천체물리개론]

This course aims to teach the introductory phenomenological astrophysics, including galaxies, supernova, black hole, super-dense astrophysical objects, gamma ray burst, gravitational wave detection, and related subjects.

PHY552 General Relativity and Cosmology [일반상대론 및 우주론]

This course aims to teach special relativity, general relativity, big bang cosmology, dark matter, dark energy, and related subjects at the introductory theoretical level.

PHY561 Plasma Physics [플라즈마 물리]

In this intermediate level course of plasma physics, basic frameworks are discoursed for understanding of waves in plasmas, diffusion, collisions and energy absorption, MHD model, nonlinear theories of plasma sheath and shock waves etc. The prerequisite is the undergraduate plasma and beam physics or similar topics.

PHY681 Special Topics in Condensed Matter Physics [고체물리 특론]

The main purpose of this course is to teach various special topics in condensed matter physics and discuss up to date theoretical and experimental results with students.

PHY682 Special Topics in Plasma and Beam Physics [플라즈마 및 빔물리 특론]

The main purpose of this course is to teach various special topics in plasma and beam physics and discuss up to date theoretical and experimental results with students.

PHY683 Special Topics in Biophysics [생체물리 특론]

The main purpose of this course is to teach various special topics in biophysics and discuss up to date theoretical and experimental results with students.

PHY684 Special Topics in Theoretical Physics [이론물리 특론]

The main purpose of this course is to teach various special topics in theoretical physics and discuss up to date theoretical and experimental results with students.

PHY685 Special Topics in Astrophysics and Cosmology [천체물리 및 우주론 특론]

The main purpose of this course is to teach various special topics in astrophysics and cosmology and discuss up to date theoretical and experimental results with students.

PHY686 Special Topics in High Energy Physics [고에너지물리 특론]

The main purpose of this course is to teach various special topics in high energy physics and discuss up to date theoretical and experimental results with students.

PHY687 Special Topics in Atomic, Molecular and Optical Physics [원자분자광물리 특론]

The main purpose of this course is to teach various special topics in atomic, molecular and optical physics and discuss up to date theoretical and experimental results with students.

PHY688 Special Topics in Computational Physics [전산물리 특론]

The main purpose of this course is to teach various special topics in computational physics and discuss up to date theoretical and experimental results with students.

PHY711 Quantum Field Theory I [양자장론 I]

This course covers the basics of relativistic quantum field theory. Starting from the Lagrangian formulation of classical fields and the standard method of field quantization, the free quantum fields, method of perturbative approach and Feynman rules are developed. Symmetries and conservations laws are duscussed and the interaction of scalar field and QED are formulated. Higher order diagram, self energy and renormalization are briefly covered.

PHY712 Quantum Field Theory II [양자장론 II]

This course further develops the formulation of relativistic quantum field theory. It covering the path integral approach to field theory, additional topics in QED, symmetry breaking, non-abelian gauge theories, the renormalization group, electroweak unification, QCD and non-perturbative methods,

PHY721 Advanced Condensed Matter Physics [고급응집물질물리]

This course deals with collective effects in solids arising from interactions between constituents. Topics include electron-electron and electron-phonon interactions, screening, band structure effects, Landau Fermi liquid theory. magnetism in metals and insulators, superconductivity; occurrence, phenomenology, and microscopic theory.

PHY723 Interface Physics of Electronic Devices [전자소자 계면물리]

The interfaces between different materials in an electronic device take crucial roles in determining the functionality and efficiency of the device. This course introduces the basic physics of various interface phenomena occurring in electronic devices, and also the experimental methods characterizing them as well. Particularly, it discusses the electronic band structure and charge/spin transport (lateral, vertical) at interfaces, and their relations to the operational mechanisms of various actual electronic devices.

PHY731 Phase Transition and Critical Phenomena [상전이와 임계현상]

This course covers the core concepts of phase transitions and critical phenomena on which modern ideas of condensed matter and statistical physics are based. Starting from the classical examples in various lattice models of magnetism, the course reviews Landau Theory and scaling hypothesis to demonstrate that the behavior of many seemingly distinct physical systems near a phase transition is qualitatively the same, leading to the concept of universality class. The modern theory of Renormalization Group will be reviewed with a reference to exemplary classical and quantum many-body systems. Finally, a hands-on introduction into non-equilibrium critical phenomena will follow. This course assumes the prerequisite knowledge of undergraduate-level thermodynamics or statistical mechanics.

PHY761 Physics of Vacuum Electron Devices [진공 전자소자 물리]

This course covers basic principles of vacuum electron devices. The electron beam formation, beam-wave interaction, and application of vacuum electron devices are the main topics of this course. The modern vacuum electron devices such as micro-vacuum electronics, and THz frequency sources will be discussed. Students are required to take pre-requisites for this course.

PHY762 Advanced Plasma Physics [고급 플라즈마 물리]

This course covers advanced topics in plasma physics. Charged particle interactions and plasma instabilities will be discussed. The nuclear fusion science will be covered in the course. The fusion related instabilities, basic and advanced plasma diagnostics, and confinement theory will be discussed. The prerequisite courses are the undergraduate level electromagnetism, and plasma physics.

PHY763 Laser-Plasma Physics [레이저-플라즈마 물리]

This course is composed of two parts. Before the midterm, diverse subjects of laser-plasma interactions including the scattering, energy absorption by Bremsstrahlung, particle acceleration, nuclear fusion, terahertz generation, wakefield, and other nonlinear interactions are briefly introduced. After the midterm, specialized lectures are given on the laser-plasma-based particle acceleration and its numerical simulation.

PHY765 Nuclear Fusion Engineering [핵융합 공학]

This course intends to cover basic principles of nuclear fusion and broad knowledge of the current technology in the world. Physics of fusion plasmas and beam-wave interaction are the main themes of the course. Students are required to take pre-requisites for this course.

PHY881 Advanced Topics in Theoretical Physics [이론물리 고등논제]

The main purpose of this course is to teach various advanced topics in theoretical physics and discuss up to date theoretical and experimental results with students.

PHY882 Advanced Topics in Experimental Physics[실험물리 고등논제]

The main purpose of this course is to teach various advanced topics in experimental physics and discuss up to date theoretical and experimental results with students.

ECE772 Nanoscale Electronic Devices [나노전자소자]

This course is intended to introduce the fundamental scientific principles and technologies of nano-scale electronic devices. We will start with discussing the basic and key concepts of semiconductor device physics, and then applying those concepts for several conventional electronic devices such as p-n junction, bipolar transistor, Schottky diode, and MOSFET. Finally, we will extend our scope to the new types of nanoscale devices that are currently under extensive research and development as candidates to overcome the limitation of current planar CMOS and flash memories, such as 3D structure transistors (dual-, tri-gate), CNT and nanowire applications, MRAM, FRAM and spintronics, etc.

MSE580 Polymer Structures and Properties [고분자구조 및 물성]

This course presents the physical properties of polymers, such as the chain confirmation, fluctuation, entanglements, etc. The macroscopic properties of polymeric materials are dramatically influenced by these changes in their microscopic state. Macromolecules beyond the simple polymers such as membranes, gels, polyelectrolytes and biopolymers and the formation of block copolymer nanostructures will also be studied.

MSE631 Electronic Properties of Materials [재료의 전자기적성질]

This class discusses the origin of electrical, magnetic and optical properties of materials, with a focus on the acquisition of quantum mechanical tools. It begins with an analysis of the properties of materials, presentation of the postulates of quantum mechanics, and close examination of the hydrogen atom, simple molecules and bonds. The course continues with the free electron model, elemental kinetic theory of thermal and electrical transport, band theory, and semiconductor physics and its applications.

MSE731 Advanced Magnetic Materials [자성재료특론]

The study of magnetism and its intricacy with electricity runs in parallel with the technological drive to find new functional materials and their applications to the electronics, such as spintronics. This course aims to provide review of microscopic and macroscopic properties magnetic materials and the subjects of intense research activities in magnetism. Topics include isolated magnetic moments, environmental effects, their mutual interactions which lead to phase transitions, Further discussion on order and broken symmetry will be provided. The class will also review intense modern research areas, such as spintronics and nanomagnetism.

PHY590 Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the seminars.

PHY690 Master's Research [석사논문연구]

This course is related to the student's graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

PHY890 Doctoral Research [박사논문연구]

This course is related to the student's graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Chemistry

□ Chemistry [CHEM]

Chemistry is a central science that seeks the understanding of the nature and interactions between atoms and molecules. In addition to this essential scientific question, modern nanoscience offers new chances to explore the world of “beyond atoms and molecules” to find and create new phenomena and materials that enlighten the world. The chemistry department provides the opportunity for graduate students to obtain a thorough fundamental knowledge of all fields of chemistry and nanoscience. The department offers lectures in all fields of chemistry and nanoscience: physical, organic, analytical, biological, and materials chemistry, polymer science, and nanoscience. The program stresses a research experience as an essential educational tool. Research opportunities with our world-class researchers are provided to all graduate students in the state-of-the art facilities and environment. Students will also enjoy the collaborative environment in the chemistry. Students can learn how to work together with colleagues in solving questions and doing research. Our goal is to educate next-generation chemists and scientists who lead the world in research and answer the question from the society and the humankind.

□ Credit Requirement

Program	Total Credits	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's –Doctoral Program	at least 54 credits	at least 36 credits	at least 18 credits

☐ Curriculum ▶ Chemistry

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
Required	CHM690	Research	Master's Research	석사논문연구	Value of Credit		
Required	CHM890	Research	Doctoral Research	박사논문연구	Value of Credit		
Elective	CHM590	Research	Seminar	세미나	1-1-0		
Elective	CHM511	Lecture	Advanced Organic Chemistry 1	고급유기화학1	3-3-0		Core Subject
Elective	CHM512	Lecture	Advanced Organic Chemistry 2	고급유기화학2	3-3-0		
Elective	CHM521	Lecture	Frontiers in Chemical Biology	고급화학생물학	3-3-0		
Elective	CHM522	Lecture	Supramolecular Chemistry	초분자화학	3-3-0		* CHM422
Elective	CHM523	Lecture	Medicinal Chemistry	의약화학	3-3-0		Core Subject, * CHM423
Elective	CHM531	Lecture	Frontier Spectroscopy	첨단분광학	3-3-0	O	* CHM431
Elective	CHM532	Lecture	Statistical Mechanics	통계역학	3-3-0		Core Subject
Elective	CHM534	Lecture	Materials for Organic Electronics	유기전자재료	3-3-0	O	
Elective	CHM535	Lecture	Physical Organic Chemistry	물리유기화학	3-3-0		
Elective	CHM541	Lecture	Inorganic Materials Analysis	무기재료분석	3-3-0		Core Subject, * CHM451
Elective	CHM542	Lecture	Advanced Quantum Chemistry	고급양자화학	3-3-0		Core Subject
Elective	CHM552	Lecture	Organometallic Chemistry	유기금속화학	3-3-0		Core Subject, * CHM452
Elective	CHM553	Lecture	Bioinorganic Chemistry	생무기화학	3-3-0		Core Subject
Elective	CHM554	Lecture	Solid State Chemistry	고체화학	3-3-0		* CHM454
Elective	CHM555	Lecture	Crystallography	결정학	3-3-0		
Elective	CHM561	Lecture	Advanced Inorganic Chemistry	고급무기화학	3-3-0		Core Subject
Elective	CHM571	Lecture	Block Copolymers	블록공중합체	3-3-0		* CHM471

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
Elective	CHM572	Lecture	Advanced Polymer Chemistry	고급고분자화학	3-3-0		Core Subject
	CHM573	Lecture	Physical Chemistry of Polymers	고분자물리화학	3-3-0		Core Subject
	CHM581	Lecture	Advanced Materials Chemistry	고급재료화학	3-3-0		Core Subject
	CHM582	Lecture	Advanced Nanoscience and Nanotechnology	고급나노과학기술	3-3-0	O	Core Subject
	CHM622	Lecture	Nanomedicine	나노의학	3-3-0	O	
	CHM624	Lecture	Advanced Protein Chemistry	고급단백질화학	3-3-0	O	Core Subject
	CHM643	Lecture	Molecular Spectroscopy	분자분광학	3-3-0		
	CHM644	Lecture	Chemical Kinetics	반응속도론	3-3-0		
	CHM645	Lecture	Chemical Physics	화학물리학	3-3-0		
	CHM651	Lecture	Inorganic Supramolecules/Metal-Organic Frameworks	무기초분자 및 금속유기 얼개	3-3-0		
	CHM681	Lecture	Advanced Instrumental Analysis	고급기기분석	3-3-0		
	CHM682	Lecture	Organic Chemistry for Materials	재료유기화학	3-3-0		
	CHM810	Lecture	Special Topics in Organic Chemistry 1	유기화학특론1	3-3-0		
	CHM811	Lecture	Special Topics in Organic Chemistry 2	유기화학특론2	3-3-0		
	CHM812	Lecture	Special Topics in Biochemistry and Chemical Biology	생화학/화학생물학특론	3-3-0		
	CHM813	Lecture	Special Topics in Organic Materials Chemistry	유기재료화학특론	3-3-0		
	CHM831	Lecture	Special Topics in Physical Chemistry	물리화학특론	3-3-0		
	CHM832	Lecture	Special Topics in Chemical Physics	화학물리학특론	3-3-0		

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence	Remark
	CHM833	Lecture	Special Topics in Theoretical Chemistry	이론화학특론	3-3-0		
	CHM834	Lecture	Special Topics in Computational Chemistry	계산화학특론	3-3-0		
Elective	CHM871	Lecture	Special Topics in Polymer Chemistry	고분자화학특론	3-3-0		
	CHM872	Lecture	Special Topics in Polymer Physics	고분자물리특론	3-3-0		
	CHM873	Lecture	Special Topics in Materials Chemistry	재료화학특론	3-3-0		
	CHM874	Lecture	Special Topics in Nanoscience	나노과학특론	3-3-0		
	CHM875	Lecture	Special Topics in Interdisciplinary Research on Carbon Materials	탄소재료연구특론	3-3-0		

※ Student in combined master's-doctoral program and doctoral program must obtain grade A from at least 2 courses from Core Subjects
※ The course mark with "*" is designed for both advanced undergraduate and first year graduate students, which is credited both for undergraduate and graduate credits.

□ Description

CHM511 & 512 Advanced Organic Chemistry 1 and 2

The goal of synthetic Chemistry is to construct target molecules from available starting materials and reagents in recognizing the various structural units, which are called synthons. The course includes conformational, synthetic and functional group analyses based on reterosynthetic approach.

CHM521 Frontiers in Chemical Biology

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.

CHM522 Supramolecular Chemistry

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.

CHM523 Medicinal Chemistry

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.

CHM531 Frontiers Spectroscopy

This course is designed for students who study 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.

CHM532 Statistical Mechanics

This course covers the equilibrium properties of matter. The central issue of thermodynamics regards the determination of the equilibrium state that eventually results after removal of internal constraints in a closed, composite system. Statistical mechanics regards the interaction between the particles composing a bulk sample, and predicts the equilibrium properties of the system that result from these interactions, exactly solvable or requiring approximations or numerical analysis.

CHM534 Materials for Organic Electronics

This course offers in-depth understandings and applications of the organic materials related to applications in electonic devices and electronics. 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.

CHM535 Physical Organic Chemistry

This course is designed for students who study in organic chemistry and physical chemistry. Physical organic chemistry mainly concerns the interrelationships between structure and reactivity in organic molecules. The course will discuss organic chemistry using tools of physical chemistry such as chemical equilibrium, chemical kinetics, thermodynamics, and quantum chemistry.

CHM541 Inorganic Materials Analysis

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.

CHM542 Advanced Quantum Chemistry

This course provides an introduction to methods of quantum mechanics, including Schrodinger equation and its solutions as applied to simple physical problems, elementary approximate methods, and scattering theory.

CHM552 Organometallic Chemistry

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.

CHM553 Bioinorganic Chemistry

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.

CHM554 Solid State Chemistry

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.

CHM555 Crystallography

He basic group theory which deals with molecular structure and symmetry will be discussed. The properties of crystals, X-rays, and the interaction between the crystal and X-ray will be covered. The theory of the molecular structure determination by X-ray diffraction will be discussed and the single-crystal structure determination will be practiced using a real data set obtained via a diffractometer.

CHM561 Advanced Inorganic Chemistry

Experimental methods and characterization tools for coordination compounds, organometallics, quantum dot, and metal nanomaterials will be introduced. The practical application of these inorganic materials will also be introduced.

CHM571 Block Copolymers

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.

CHM572 Advanced Polymer Chemistry

This course will provide advanced level topics in Polymer Chemistry including an introduction to Polymer Chemistry. The course is designed to deliver graduate students a comprehensive understanding of the Chemistry of polymer synthesis and the modern synthetic chemistry and strategy for polymers, block copolymers, and architectural polymers. Recent advances in organic and inorganic/organometallic chemistry will be applied to synthetic polymer chemistry.

CHM573 Physical Chemistry of Polymers

This course will provide advanced level topics in Physical Polymer Chemistry. The course is designed to deliver graduate students a comprehensive understanding of the Chemistry of polymers and the physical behaviors of polymers. Topics will cover (i) Chemistry of polymers, (ii) physical properties of polymers, (iii) solution thermodynamics of polymers, and (iv) advanced topics in polymer chemistry and physical chemistry of polymers.

CHM581 Advanced Materials Chemistry

This course is intended primarily as an introduction course to materials and solid state chemistry for graduate students and advanced undergraduate students. The objective is to understand solids from a chemical perspective and introduce general solid state synthesis methodologies and characterization techniques. Topics covered will include structure and structure determination of crystalline solids; free electron model for metal; electronic band structure; chemical bonding in solids; and structure-property relationships.

CHM582 Advanced Nanoscience and Nanotechnology

This course presents a review of recent scientific papers in modern nanoscience and nanotechnology, and introduces principles of sciences and technologies appearing in the review. This course deals with advanced subjects.

CHM622 Nanomedicine

This course is intended primarily as an introduction course to the applications of nanoscience in medicine and biomedical fields. Nanosystems that can be used as drug delivery vehicles, cell-culture platforms, and therapeutic molecules and systems will be discussed.

CHM624 Advanced Protein Chemistry

This course presents a review of recent protein chemistry centered on post-translational modification of proteins and their use in signal transduction and metabolism.

CHM643 Molecular Spectroscopy

This course provides the basic principles of interaction of light and matter and their application in spectroscopy of atoms and molecules. In this course, covered will be how to describe absorption and emission of light by atoms and molecules, and how to characterize atomic and molecular states and molecular behavior by spectroscopy.

CHM644 Chemical Kinetics

The main goal of this course is to deliver the principles of reaction kinetics and catalysis. Topics covered will include the laws and theories governing rates of chemical reactions and reaction mechanisms in the gas phase, in soluion, and at the solid-liquid interface. Emphasis is placed on modern experimental approaches to study kinetics in complex chemical and biochemical/biophysical systems.

CHM645 Chemical Physics

Chemical physics is a subdiscipline of chemistry and physics that investigates physicochemical phenomena using techniques from atomic and molecular physics and condensed matter physics. This course is designed to deliver physical approaches to chemical problems and to discuss recent issues in chemical phycis.

CHM651 Inorganic Supramolecules/Metal-Organic Frameworks

This course covers the basics of supramolecular chemistry of inorganic molecules and complexes, which yield highly ordered regular materials having precisely defined porous/crystalline structures. The course will discuss about the chemistry of metal-organic frameworks; synthesis, structures, and properties. Applications of these highly interesting materials will be also discussed.

CHM681 Advanced Instrumental Analysis

The course is designed to deliver theories and practices of modern instrumental analysis for nanoscience, Chemistry, Biology, and Chemical engineering. The lectures will cover (1) Theories for modern instrumental analysis, (2) NMR Spectroscopy, (3) Absorption Spectroscopy, (4) Surface Analysis, (5) Electron Microscopy, (6) Scanning Tunneling Microscopy and Atomic Force Microscopy, (7) Recent examples of modern instrumental analysis.

CHM682 Organic Chemistry for Materials

The course discusses organic chemistry and its application to materials science. Synthetic organic chemistry has widely adopted to synthesize molecules that play a crucial role in modern materials such as optoelectronic materials and biomedical materials. This course will discuss a few useful organic reactions and materials for modern materials.

CHM810-875 Special Topics in Chemistry

This course is designed to introduce the current trends and the state-of the-art states of nanotechnologies, biotechnologies and chemistry-related technologies. To keep the flexibility of the course, the topics and the instructors will be changed every semesters.

CHM590 The Seminars

The purpose of this course is to extend knowledge to the state-of-the-art R&D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the Seminars.

CHM690 Master's Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

CHM890 Doctoral Research

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

Department of Mathematical Sciences

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 conventional study on mathematical structures, the mathematical research at UNIST is devoted to encompass some of the most diverse and interdisciplinary research in the physical, engineering, and biological sciences. The department provides a dynamic and engaging research environment that is especially strong in scientific computing, mathematical biology and modern mathematical methods.

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

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits (at least 15 credits from Mathematical Sciences and 3 credits from other disciplines)	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits (at least 12 credits from Mathematical Sciences and 3 credits from other disciplines)	at least 14 credits
Combined Master's-Doctoral Program	at least 54 credits	at least 36 credits (at least 24 credits from Mathematical Sciences and 6 credits from other disciplines)	at least 18 credits

□ Curriculum ▶ Mathematical Sciences

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.–Lect.–Exp.	Convergence
Elective	MTH501	Lecture	Real analysis	실해석학	3-3-0	
	MTH502	Lecture	Functional Analysis	함수해석학	3-3-0	
	MTH503	Lecture	Probability and stochastic processes	확률 및 확률 과정론	3-3-0	
	MTH505	Lecture	Numerical Analysis and applications	수치해석 및 응용	3-3-0	
	MTH507	Lecture	Numerical linear algebra	수치선형대수	3-3-0	
	MTH509	Lecture	Partial Differential Equations	편미분방정식	3-3-0	
	MTH510	Lecture	Nonlinear Partial Differential Equations	비선형 편미분방정식	3-3-0	O
	MTH511	Lecture	Numerical Methods for partial differential equations I	편미분방정식의 수치방법 I	3-3-0	
	MTH512	Lecture	Numerical Methods for partial differential equations II	편미분방정식의 수치방법 II	3-3-0	
	MTH513	Lecture	Dynamical systems	동적 시스템	3-3-0	
	MTH515	Lecture	Mathematical Methods for Engineers	공학자를 위한 수학방법	3-3-0	O
	MTH517	Lecture	Stochastic Calculus and applications	확률 미적분과 응용	3-3-0	
	MTH519	Lecture	Advanced statistics	고급 통계	3-3-0	
	MTH521	Lecture	Computational Statistics for Bioscience	생명과학을 위한 계산 통계	3-3-0	O
	MTH531	Lecture	Scientific Computing	과학계산	3-3-0	
	MTH532	Lecture	Advanced Scientific Computing	고급과학계산	3-3-0	
	MTH711	Lecture	Selected topics in computational mathematics I	계산수학 특론 I	3-3-0	
	MTH712	Lecture	Selected topics in computational mathematics II	계산수학 특론 II	3-3-0	
	MTH713	Lecture	Selected topics in partial differential equations	편미분방정식 특론	3-3-0	
	MTH714	Lecture	Selected topics in mathematical biology	생물수학 특론	3-3-0	O
	MTH715	Lecture	Selected topics in probability and statistics	확률과 통계 특론	3-3-0	
	MTH590	Research	Seminar	세미나	1-1-0	
	MTH690	Research	Master's Research	석사 연구	Value of credit	
	MTH890	Research	Doctoral Research	박사 연구	Value of credit	

☐ Description

MTH501 Real analysis [실해석학]

Real analysis is fundamental to many of the other courses in applied mathematics. Topics include metric spaces, Banach spaces, measure theory, and the theory of integration and differentiation.

MTH502 Functional analysis [함수해석학]

This covers certain topological-algebraic structures that can be applied analytic problems. Topics include Topological vector spaces, Completeness, Convexity, Duality in Banach spaces, Distributions, Fourier transforms, Banach algebras, Bounded and unbounded operators on a Hilbert spaces.

MTH503 Probability and stochastic processes [확률 및 확률과정론]

Basic and advanced theories in probability and stochastic processes will be covered including expectation, conditional probability, law of large numbers, central limit theorem, markov chains, martingales, and Brownian motions.

MTH505 Numerical Analysis and applications [수치해석 및 응용]

This course emphasizes the development of basic numerical algorithms for common problems formulated in science and engineering. The course covers interpolation and approximation of functions, numerical differentiation and integration, numerical solutions of ordinary differential equations and direct and iterative methods in linear algebra.

MTH507 Numerical linear algebra [수치 선형대수]

This course covers basic theory and methods for matrix computation. LU-decomposition, QR factorization, least square method. Condition numbers and accuracy. Solutions of large sparse matrix system and iterative methods.

MTH509 Partial Differential Equations [편미분방정식]

This course covers the theory of the classical partial differential equations, the method of characteristics for first order equations, the Fourier transform, the theory of distributions in Sobolev spaces, and techniques of functional analysis.

MTH510 Nonlinear Partial Differential Equations [비선형 편미분방정식]

This course covers the theory of the nonlinear partial differential equations, the method of characteristics for first order equations, Quasilinear equations, Fixed point theorems, and fully nonlinear equations.

MTH511 Numerical Methods for partial differential equations I [편미분방정식의 수치방법 I]

Finite difference methods for solving ordinary and partial differential equations. Fundamental concepts of consistency, accuracy, stability and convergence of finite difference methods will be covered. Associated theory will be discussed.

MTH512 Numerical Methods for partial differential equations II [편미분방정식의 수치방법 II]

Finite element methods for ordinary and partial differential equations will be covered. Algorithm development, analysis, and computer implementation issues will be addressed. Also we will discuss the generalized and discontinuous Galerkin finite element method.

MTH513 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.

MTH515 Mathematical Methods for Engineers [공학자를 위한 수학방법]

This course provides concise introductions to mathematical methods for problems formulated in science and engineering. Some selected topics are functions of a complex variable, Fourier analysis, calculus of variations, perturbation methods, special functions, dimension analysis, tensor analysis.

MTH517 Stochastic Calculus and applications [확률 미적분과 응용]

Brownian motion, Ito's rule, stochastic integrals, and stochastic differential equations as well as their numerical simulations are covered. Application to chemistry, finance and partial differential equations will be also included

MTH519 Advanced statistics [고급 통계]

Mathematical backgrounds for basic statistical analyses are covered. We deal with properties of probability distributions, limit theorems including laws of larger numbers and central limit theorem, theories for hypothesis test and inference, analysis of variance, and non-parametric analysis

MTH521 Computational Statistics for Bioscience [생명과학을 위한 계산 통계]

Linear model, multivariate analysis, survival analysis and some machine learning methods for genome and clinical data analysis using R software

MTH531 Scientific Computing [과학계산]

This course provides 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. This course may involve numerical coding assignments and some use of software packages.

MTH532 Advanced Scientific Computing [고급과학계산]

Topics include an overview of computer hardware, software tools and packages, commonly used numerical methods, visualization of results, high-performance computing and parallel programming. This course may involve numerical coding assignments and some use of software packages.

MTH711 Selected topics in computational mathematics I [계산수학 특론 I]

This course covers topics of current interest in computational mathematics for solving linear and nonlinear partial differential equations.

MTH712m Selected topics in computational mathematics II [계산수학 특론 II]

This course covers topics of current interest in computational mathematics for solving linear and nonlinear partial differential equations.

MTH713 Selected topics in partial differential equations [편미분방정식 특론]

This course covers an introduction of L_p theory of elliptic and parabolic differential equation and theory of Navier-Stokes equations.

MTH714 Selected topics in mathematical biology [생물수학 특론]

This course covers advanced topics in mathematical biology including modeling in biochemical networks, population dynamics, and tumor cell growth.

MTH715 Selected topics in probability and statistics [확률과 통계 특론]

Special topics in probability & statistics and their recent applications in science and engineering will be covered.

MTH590 Seminar [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R & D in real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the seminars.

MTH690 Master's Research (1-3 credits) [석사 연구]

This course is related to the students graduate thesis. As such, students should be actively working on their research problems.

MTH890 Doctoral Research (3-9 credits) [박사 연구]

This course is related to the students graduate thesis. As such, students should be actively working on their research problems.

Department of Management Engineering

□ Management Engineering [ME]

In order to make better decision in the complex business world, managers need a wide range of management knowledge and a variety of approaches on business problems. Management Engineering is a discipline which explains the business world through the combination of management knowledge and systematic/engineering methodologies. Thus, the Management Engineering Program not only includes various management courses but also offers courses related to business analytics, such as Data Mining, Decision-Making Theory, and Information Management.

□ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 60 credits	at least 42 credits	at least 18 credits

☐ Curriculum ▶ Management Engineering

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence
Required	MGT690	Lecture	Master's Research	석사연구	Value of Credit	
Required	MGT890	Lecture	Doctoral's Research	박사 연구	Value of Credit	
Elective	MGE501	Lecture	Information Management & Analysis	정보관리 및 분석	3-3-0	
Elective	MGE502	Lecture	Statistical Programming	통계프로그래밍	3-3-0	
Elective	MGE503	Lecture	Advanced Data Mining	고급 데이터마이닝	3-3-0	
Elective	MGE504	Lecture	Business Modeling and Decision Making	비즈니스 모델링 및 의사결정	3-3-0	
Elective	MGE505	Lecture	Mathematical programming	수리계획법	3-3-0	
Elective	MGE506	Lecture	Supply Chain Management	공급망관리	3-3-0	
Elective	MGE507	Lecture	Optimization Theory	최적화 이론	3-3-0	
Elective	MTH501	Lecture	Real analysis	실해석학	3-3-0	
Elective	MTH503	Lecture	Probability and stochastic processes	확률 및 확률 과정론	3-3-0	
Elective	MTH505	Lecture	Numerical Analysis and applications	수치해석 및 응용	3-3-0	
Elective	MTH509	Lecture	Partial Differential Equations	편미분방정식	3-3-0	
Elective	MTH511	Lecture	Numerical Methods for partial differential equations I	편미분방정식의 수치방법 I	3-3-0	
Elective	MTH513	Lecture	Dynamical systems	동적 시스템	3-3-0	
Elective	MTH515	Lecture	Mathematical Methods for Engineers	공학자를 위한 수학방법	3-3-0	
Elective	MTH517	Lecture	Stochastic Calculus and applications	확률 미적분과 응용	3-3-0	
Elective	MTH531	Lecture	Scientific Computing	과학계산	3-3-0	
Elective	MTH591	Lecture	Introduction to Mathematical Analysis	해석학 개론	3-3-0	
Elective	MGE551	Lecture	Special Topics in ME I	ME 특론 I	3-3-0	
Elective	MGE552	Lecture	Special Topics in ME II	ME 특론 II	3-3-0	
Elective	MGE553	Lecture	Special Topics in ME III	ME 특론 III	3-3-0	
Elective	MGE554	Lecture	Special Topics in ME Ⅳ	ME 특론 Ⅳ	3-3-0	
Elective	MGE555	Lecture	Special Topics in ME Ⅴ	ME 특론 Ⅴ	3-3-0	

□ Description

MGT 690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MGT 890 Doctoral's Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MGE501 Information Management & Analytics [정보관리 및 분석]

In this course, students will study how information is produced and managed in enterprises. Main topics discussed include: the principles of information management; information management technologies; techniques to analyze information needs and use; and the social and ethical context of information management.

MGE502 Statistical Programming [통계 프로그래밍]

This course will provide students with analytical and decision making skills through a variety of topics in statistics and optimization modeling. Underlying theory for statistical analysis and its business applications will be emphasized. This helps students evaluate and handle business situations with statistics in mind. As a result, students will be well prepared to describe and analyze data for decision makings in business fields such as marketing, operations, and finance. This course aims to teach students programming techniques for managing, and summarizing data, and reporting results.

MGE503 Advanced Data Mining [고급 데이터 마이닝]

Data mining is the process of discovering new patterns from large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics and database systems. The basic data mining techniques and their use in a business context will be addressed. Furthermore, an advanced topic in data mining (i.e. process mining) will also discussed in the class.

MGE504 Business Modeling and Decision Making [비즈니스 모델링 및 의사결정]

This course will enable students to build deterministic and probabilistic models of business problems that lead to making better managerial decisions. Students will acquire the necessary skills to analyze complex business situations, develop mathematical models of those situations, explore and prioritize alternative solutions through formalized approaches, and do “what if?” sensitivity analysis to gain insight into why the chosen solution makes business sense. Among the topics covered will be linear and integer programming, dynamic programming, non-linear optimization, Monte Carlo simulation, decision analysis and utility theory, and multi-criteria decision making.

MGE505 Mathematical Programming [수리계획법]

This course provides an introduction to the optimization problems, algorithms and techniques, emphasizing basic methodologies and the underlying mathematical structures. The main subjects covered include basic linear programming, nonlinear programming, network flow problems, dynamic optimization, and applications.

MGE506 Supply Chain Management [공급망관리]

Derived from domestic and global competition, firms in many industries seek to create innovative ways to move products from raw materials through the manufacturing process to customers more efficiently and effectively. Such innovation has been facilitated by the development of information technology. The firms redesign their supply chains to collect, process, transmit, share, and use a large amount of information with efficacy. Still others are focusing on cooperative relationships among all the players in the value chain and bypassing unneeded stages. This course examines many of the recent innovations in this area with an emphasis on technologies

MGE507 Optimization Theory [최적화 이론]

Disciplined thought is often based on analytical models: simplified, quantitative depictions of a complex reality that allow you to focus your attention on a few key issues. Management runs on numbers and models. This course covers the strengths and weaknesses of these quantitative models. Furthermore this course focuses on models built using spreadsheets and, in particular, concentrates on optimization of spreadsheet models. Finally this course will instruct students on the use of discrete event simulation to model phenomena subject to random influences.

MTH501 Real analysis [실해석학]

Real analysis is fundamental to many of the other courses in applied mathematics. Topics include metric spaces, Banach spaces, measure theory, and the theory of integration and differentiation.

MTH503 Probability and stochastic processes [확률 및 확률 과정론]

Basic and advanced theories in probability and stochastic processes will be covered including expectation, conditional probability, law of large numbers, central limit theorem, markov chains, martingales, and Brownian motions.

MTH505 Numerical Analysis and applications [수치해석 및 응용]

This course emphasizes the development of basic numerical algorithms for common problems formulated in science and engineering. The course covers interpolation and approximation of functions, numerical differentiation and integration, numerical solutions of ordinary differential equations and direct and iterative methods in linear algebra.

MTH509 Partial Differential Equations [편미분방정식]

This course covers the theory of the classical partial differential equations, the method of characteristics for first order equations, the Fourier transform, the theory of distributions in Sobolev spaces, and techniques of functional analysis.

MTH511 Numerical Methods for partial differential equations I [편미분방정식의 수치방법 I]

Finite difference methods for solving ordinary and partial differential equations. Fundamental concepts of consistency, accuracy, stability and convergence of finite difference methods will be covered. Associated theory will be discussed.

MTH513 Dynamical systems [동적시스템]

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.

MTH515 Mathematical Methods for Engineers [공학자를 위한 수학방법]

This course provides concise introductions to mathematical methods for problems formulated in science and engineering. Some selected topics are functions of a complex variable, Fourier analysis, calculus of variations, perturbation methods, special functions, dimension analysis, tensor analysis.

MTH517 Stochastic Calculus and applications [확률 미적분과 응용]

Brownian motion, Ito's rule, stochastic integrals, and stochastic differential equations as well as their numerical simulations are covered. Application to chemistry, finance and partial differential equations will be also included.

MTH531 Scientific Computing [과학계산]

This course provides 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. This course may involve numerical coding assignments and some use of software packages.

MTH591 Introduction to Mathematical Analysis [해석학 개론]

This course is a beginning of the mathematics that includes the rigorous theories of differentiation, integration, sequences, infinite series, and limit of functions. These subjects are studied in the context of real numbers, complex numbers, and real and complex functions.

MGE551 Special Topics in ME I ME [특론 I]

This course introduces graduate students with current and special topics in Management Engineering.

MGE552 Special Topics in ME II ME [특론 II]

This course introduces graduate students with current and special topics in Management Engineering.

MGE553 Special Topics in ME III ME [특론 III]

This course introduces graduate students with current and special topics in Management Engineering.

MGE554 Special Topics in ME Ⅳ ME [특론 Ⅳ]

This course introduces graduate students with current and special topics in Management Engineering.

MGE555 Special Topics in ME Ⅴ ME [특론 Ⅴ]

This course introduces graduate students with current and special topics in Management Engineering.

Department of Management

☐ Management [GM]

The Management area is designed to provide general management education and committed to enhancing knowledge of business and management issues on all major functional areas. Courses covered in General Management include Organizational Behavior, International Business, Marketing, Financial Accounting, Managerial Accounting, Financial Management, Strategic Management, Operations Management, Economics, and Data Analysis & Decision Making.

☐ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 60 credits	at least 42 credits	at least 18 credits

☐ Curriculum ▶ Management

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence
Required	MGT690	Research	Master's Research	석사 연구	Value of Credit	
Required	MGT890	Research	Doctoral's Research	박사 연구	Value of Credit	
Elective	MGT501	Lecture	Microeconomic Theory	미시경제이론	3-3-0	
Elective	MGT502	Lecture	Macroeconomic Theory	거시경제이론	3-3-0	
Elective	MGT511	Lecture	Research Methodology	연구방법론	3-3-0	
Elective	MGT512	Lecture	Econometrics	계량경제학	3-3-0	
Elective	MGT513	Lecture	Multivariate Analysis	다변량 분석	3-3-0	
Elective	MGT515	Lecture	Probability Models with Applications	확률모형론	3-3-0	
Elective	MGT521	Lecture	Business Ethics	기업윤리	1-1-0	

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence
Elective	MGT590	Seminar	Seminars	세미나	1-1-0	
Elective	MOT501	Lecture	Theories & Practices in Technology Management	기술경영 이론과 사례	3-3-0	
Elective	MOT502	Lecture	Organizational Change & Innovation Management	조직변화와 혁신경영	3-3-0	
Elective	MOT511	Lecture	Organizational Behavior Theory	조직행위	3-3-0	
Elective	MOT512	Lecture	Strategic Management Theory	경영전략	3-3-0	
Elective	MOT513	Lecture	High Tech Management	하이테크 기술경영	3-3-0	
Elective	MOT514	Lecture	Intellectual Property Management	지적재산권 경영	3-3-0	
Elective	MIS501	Lecture	IT for Networked Organizations	기업과 정보기술	3-3-0	
Elective	MIS502	Lecture	Data Mining	데이터마이닝	3-3-0	
Elective	MIS511	Lecture	IT Economics	IT 이코노믹스	3-3-0	
Elective	MIS512	Lecture	Mobile Technology & Business Innovation	모바일 기술과 비즈니스 혁신	3-3-0	
Elective	MIS513	Lecture	IT Strategy	IT 전략	3-3-0	
Elective	MKT501	Lecture	Marketing Research & Analysis	마케팅 조사와 분석	3-3-0	
Elective	MKT502	Lecture	Research Seminar in Consumer Behavior	소비자행동 세미나	3-3-0	
Elective	MKT503	Lecture	Marketing Strategy	마케팅 전략	3-3-0	
Elective	MKT504	Lecture	Advertising and Marketing Communications	광고와 마케팅 커뮤니케이션	3-3-0	
Elective	MKT511	Lecture	Market Assessment	시장 측정론	3-3-0	
Elective	MKT512	Lecture	Strategic Brand Management	전략적 브랜드관리	3-3-0	
Elective	MKT513	Lecture	Research Seminar in International Business	국제경영 세미나	3-3-0	
Elective	MKT514	Lecture	New Products Planning, Developing and Marketing	신제품 기획, 개발 및 마케팅	3-3-0	
Elective	MGT540	Lecture	Special Topics in General Management I	GM 특론 I	3-3-0	
Elective	MGT541	Lecture	Special Topics in General Management II	GM 특론 II	3-3-0	
Elective	MGT542	Lecture	Special Topics in General Management III	GM 특론 III	3-3-0	
Elective	MGT543	Lecture	Special Topics in General Management Ⅳ	GM 특론 Ⅳ	3-3-0	
Elective	MGT544	Lecture	Special Topics in General Management Ⅴ	GM 특론 Ⅴ	3-3-0	

□ Description

MGT501 Microeconomic Theory [미시경제이론]

The course offers graduate level students a systematic presentation of microeconomic theories. The use of mathematics to formulate and analyze economic models facilitates a more rigorous and thorough mastery of microeconomic theory. Mastery of these basic models of microeconomic analysis will provide students with the essential tools for solving a wide variety of applied economics and public policy problems. Topics will include consumer choice, firm behavior, market structure, game theory, factor markets and general equilibrium.

MGT502 Macroeconomic Theory [거시경제이론]

This course aims to provide students a basic understanding of theoretical foundations of macroeconomics at the graduate level. This course introduces basic macroeconomic models that help students understand the interactions of key macroeconomics variables (output, prices, and employment) and the impact of macroeconomic policies. The topics will include economic fluctuation, economic growth, monetary and fiscal policies.

MGT511 Research Methodology [연구방법론]

In this course, students will learn key issues and perspectives of scientific research methodology. The primary objective of this course is to provide the theoretical foundations and practical skills to effectively apply qualitative and quantitative research methods in business disciplines. It will help students formulate research questions, do independent literature research, analyze/interpret qualitative and quantitative data, and establish evaluation criteria. Further, the course helps students develop their ability to collect data in an appropriate manner.

MGT512 Econometrics [계량경제학]

This course aims to introduce students to quantitative techniques commonly used in economic analysis and research. This course focuses on the application of statistical methods to the testing and estimation of economic relationships. Students will be introduced to econometric tools of analysis, and will be prepared to perform analytical and statistical work in economics and other applied research areas.

MGT513 Multivariate Analysis [다변량 분석]

This course provides the basic concepts in statistics and applications to economics and management areas. It covers the use of multivariate normal sampling theory, linear transformations of random variables, and multi-sample tests, partial and multiple correlations, multivariate ANOVA and least squares, principal components analysis, and specially related topics.

MGT515 Probability Models with Applications [확률모형론]

This course is designed to provide students with advanced-level probability models with various applications required for graduate level research. The subjects covered in the course include the basic concepts in probability, discrete and continuous distributions, sampling distribution theory, and other related probability theories.

MGT 521 Business Ethics [기업윤리]

The purpose of this course is to enable students to reason about the role of ethics in trading and contracting in the energy commodity trading and financial market. In the course, students will participate in a series of case study discussions, focusing on analyzing the issues in moral terms and then making decisions and developing a set of reasons why the decision can ethically justified. During the discussion, additionally, students will think about the impact of their financial transactions on stakeholders and societies.

MGT 590 The Seminars [세미나]

The purpose of this course is to extend knowledge to the state-of-the-art R&Din real scientific fields; and to get indirect experience by contacting experts in various fields. Students and professors can exchange their own ideas and information to reach creative and fine-tuned achievements through the seminars.

MGT 540 Special Topics in General Management I [GM 특론 I]

This course introduces graduate students with current and special topics in General Management.

MGT 541 Special Topics in General Management II [GM 특론 II]

This course introduces graduate students with current and special topics in General Management.

MGT 542 Special Topics in General Management III [GM 특론 III]

This course introduces graduate students with current and special topics in General Management.

MGT 543 Special Topics in General ManagementIV [GM 특론 IV]

This course introduces graduate students with current and special topics in General Management.

MGT 544 Special Topics in General Management V [GM 특론 V]

This course introduces graduate students with current and special topics in General Management.

MGT 690 Master's Research [석사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MGT 890 Doctoral's Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MOT501 Theories & Practices in Technology Management [기술 경영과 이론사례]

This course covers the challenges embedded in attempting to benefit from both incremental or routine innovation and more radical or revolutionary changes in products and processes. It also highlights the importance of innovation to both new ventures and to large established companies, and explores the organizational, economic and strategic problems that must be understood to ensure innovation is a long term source of competitive advantage. Based on the knowledge about the problems identified, students will learn to analyze the problems, and discuss and investigate the strategies to overcome the problems.

MOT502 Organizational Change & Innovation Management [조직변화와 혁신경영]

Successful companies are transforming themselves towards innovation models that involve everyone in the organization. Leaders who understand how to enable a cadence of innovation though/along with others will create a competitive advantage. In this class students will learn and apply three levels of knowledge: 1) innovation practices of global organizations, 2) how to embed innovation in an organization through business processes and core competencies, 3) capability tools to create a pipeline of innovation.

MOT511 Organizational Behavior Theory [조직행위]

Based on the discipline of social and managerial psychology, this course aims to cultivate mindsets and building skills to understand how organizations and their members affect one another. This course covers the diagnosis and resolution of problems in organizational settings. Students will learn theories and research related to organizational problems by identifying individual motivation and behavior, decision-making, interpersonal communication and influence, small group behavior, individual, and inter-group conflict and cooperation.

MOT512 Strategic Management Theory [경영전략]

This course introduces concepts, theories, approaches and analytical models associated with the process of strategy formation and implementation in both profit and non-profit organizations. It also provides opportunities to make strategic analyses and to make decisions for strategic issues of real organizations through participation in class discussions and performing group term projects.

MOT513 High Tech Management [하이테크 기술 경영]

This course explores the unique aspects of creating an effective strategy in technology- intensive businesses such as R&D investment, network externalities, technology development, technology based competitive advantages. Though many firms invest heavily in R&D, they are likely to experience their competitors taking advantage of their work. Others build great technologies, but fail to build the necessary complements and infrastructure to support the technology. This course tackles these issues directly, providing a series of frameworks that can be applied directly to a wide range of strategic problems.

MOT514 Intellectual Property Management [지적재산권 경영]

The course, Intellectual Property Management, focuses on intellectual property from the perspective of ‘why’ and ‘how’ for participants who have already covered the basics of ‘what’ Intellectual Property is.

MIS501 IT for Networked Organizations [기업과 정보기술]

This course will provide students with an opportunity to study advanced topics in IT and MIS fields, both theoretically and practically. Topics include enterprise information systems, e-business, IT architectures, database management and system development.

MIS502 Data Mining [데이터 마이닝]

Firms are likely to use various techniques of data mining for credit ratings, fraud detection, database marketing, customer relationship management, investments, and logistics are. This course introduces methods for data mining that help managers recognize patterns and use electronic data collected via the internet, e-commerce, electronic banking, point-of-sale devices, bar-code readers, and intelligent machines. This course covers the techniques such as subset selection in regression, collaborative filtering, tree-structured classification and regression, cluster analysis, and neural network methods.

MIS511 IT Economics [IT 이코노믹스]

Information technology (IT) creates great opportunities for business by fundamentally reshaping products/services, operations, and business relationships. The course provides an in-depth economic analysis of the phenomena with managerial implications. It will cover economic value of information technology and its impact on industry and organizational structure. We will also examine such topics including, competition, pricing, bundling and versioning of information goods and network effects.

MIS512 Mobile Technology & Business Innovation [모바일 기술과 비즈니스 혁신]

By taking a journey into the history of mobile technologies/services and their current trends, this course investigates how mobile technologies have transformed and will continue to transform the world. The course explores various mobile technologies, their business applications, successful and failed cases, and related issues such as mobile policy or convergence among wired, wireless, and broadcasting services.

MIS513 IT Strategy [IT 전략]

This course focuses on exploring and articulating the framework and methodology associated with investment in Information Technology to formulate and execute business strategy. This course will help students understand opportunities and challenges that firms confront in their IT investment decision making. Firms need to use IT to deliver business value. Today, IT is so closely related with business strategy and activities, and firms need strategy for IT management. Topics include IT values in business, IT impact on business model and on organizations.

MKT501 Marketing Research and Analysis [마케팅 조사와 분석]

Marketing Research and Analysis is designed to provide a conceptual framework and real-world applications for the role of research in managerial decision making. This framework will include a basic understanding of the research process, from the proposal stage to presenting the final results. The course will discuss key elements and issues in marketing research: sources of data, data collection techniques, specific applications of research for decision making, and analytical approaches for understanding the implications of the data for marketing decisions.

MKT502 Research Seminar in Consumer Behavior [소비자 행동 세미나]

Studies nature and determinants of consumer behavior: how different psychological characteristics and processes affect how people act when they buy, use, and experiences products or services. The impact of consumer decisions on the marketing strategies of organizations.

MKT503 Marketing Strategy [마케팅 전략]

Develops framework for strategic marketing plan based on customer behavior, market segmentation, product positioning, product life cycle, market responsiveness, and competitive reaction. Analysis of complex marketing problems involving policy and operational decisions; emphasis on creative marketing strategy.

MKT504 Advertising and Marketing Communications [광고와 마케팅 커뮤니케이션]

Examines marketing promotions from a communication standpoint. Discusses advertising, sales promotion, personal selling and publicity as components of the promotional program of an enterprise, including profit and nonprofit institutions marketing products and/or services. Emphasizes the planning, design and implementation of advertising campaigns.

MKT511 Market Assessment [시장 측정론]

Provides the tools to use to size a market opportunity such as customer need assessment, different methods for market segmentation and product positioning. Diffusion of innovation processes, conjoint analysis, and other methods for discerning preferences, and the role of competition.

MKT512 Strategic Brand Management [전략적 브랜드관리]

Brand management practices of for-profit and non-profit organizations. Understanding, crafting, measuring, and management of brand strategies. The strategic establishment of brand identities.

MKT513 Research Seminar in International Business [국제경영 세미나]

Analyzes marketing strategy across national boundaries, the problems of marketing within foreign countries, and the coordination of global marketing programs. Provides an analysis of marketing concepts and applications in a global environment, focusing on market management and cultural and institutional differences.

MKT514 New Products Planning, Developing and Marketing [신제품 기획, 개발 및 마케팅]

Considers the role of new products in the survival and growth strategies of organizations. Focuses on the major problems firms encounter in directing and managing their product development and marketing activities. Examines the development process from conception of ideas to commercial introduction, and the marketing life cycle from introduction to deletion of products.

Department of Finance & Accounting

☐ Finance & Accounting [FA]

Finance is an area to study the ways in which individuals, corporations, and other business organizations allocate resources and make financial decisions in the 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, Accounting Information System, and Auditing which cover the principles and practices of accounting.

☐ Credit Requirement

Program	Total Credits required	Course Credit	Research Credit
Master's Program	at least 28 credits	at least 24 credits	at least 4 credits
Doctoral Program	at least 32 credits	at least 18 credits	at least 14 credits
Combined Master's-Doctoral Program	at least 60 credits	at least 42 credits	at least 18 credits

☐ Curriculum ▶ Finance & Accounting

Course is	Course No.	Classification	Course Title	Course Title (Kor.)	Cred.-Lect.-Exp.	Convergence
Required	MGT690	Research	Master's Research	석사 연구	Value of Credit	
Required	MGT890	Research	Doctoral's Research	박사 연구	Value of Credit	
Elective	FIN501	Lecture	Corporate Finance	기업재무론	3-3-0	
Elective	FIN502	Lecture	Derivative Securities	파생상품론	3-3-0	
Elective	FIN511	Lecture	Financial Markets and Institutions	금융기관론	3-3-0	
Elective	FIN512	Lecture	Financial Risk Management	금융위험 관리론	3-3-0	
Elective	FIN513	Lecture	Theory of Finance	재무이론 연구	3-3-0	
Elective	FIN514	Lecture	Empirical Methods in Finance	재무실증 연구	3-3-0	
Elective	ACT501	Lecture	Financial Accounting and Reporting Theory	재무회계 이론	3-3-0	
Elective	ACT503	Lecture	Auditing Theory & Practice	회계 감사 이론과 실제	3-3-0	
Elective	ACT504	Lecture	Contemporary Issues in Accounting	현대회계이론	3-3-0	
Elective	ACT512	Lecture	Accounting Information Systems	회계 정보시스템	3-3-0	
Elective	ACT513	Lecture	Research Methodology in Accounting	재무회계 연구방법론	3-3-0	
Elective	FIN551	Lecture	Special Topics in FIA I	FIA 특론 I	3-3-0	
Elective	FIN552	Lecture	Special Topics in FIA II	FIA 특론 II	3-3-0	
Elective	ACT502	Lecture	Special Topics in FIA III	FIA 특론 III	3-3-0	
Elective	ACT511	Lecture	Special Topics in FIA Ⅳ	FIA 특론 Ⅳ	3-3-0	
Elective	ACT551	Lecture	Special Topics in FIA Ⅴ	FIA 특론 Ⅴ	3-3-0	

□ Description

MGT 690 Master's Research [석사 논문 연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

MGT 890 Doctoral's Research [박사논문연구]

This course is related with the students graduate thesis and dissertation. As such, students should be actively working in a laboratory setting and gaining experience through hands-on experimentation.

FIN501 Corporate Finance [기업재무론]

This course is designed to provide a conceptual framework for understanding the field of corporate finance. The issues addressed in this course include time value of money, relation between risk and return, capital budgeting, and capital structure under certainty and uncertainty. This course will emphasize the logical structure of various theories and empirical evidence.

FIN502 Derivative Securities [파생상품론]

This course introduces the valuation models and risk management techniques used in options, futures and other derivative securities. It helps students understand derivative securities in detail by examining the structures of markets, analyzing pricing models and examining related empirical results.

FIN511 Financial Markets and Institutions [금융기관 관리론]

This course focuses on the nature and the role of financial institutions in various capital and financial markets. It will cover the financial system and financial service industry, and addresses the various issues concerning risk measurement and management of various financial institutions.

FIN512 Financial Risk Management [금융위험 관리론]

This course is designed to introduce students to basic issues of financial risk management including the definition of risk, measures of financial risk and the concept of financial risk management. It will focus on various risk management techniques to estimate value-at-risk. Practical problems for financial institutions and firms are discussed in class.

FIN513 Theory of Finance [재무이론 연구]

This course studies the mathematical and economic foundations for discrete and continuous time models in modern finance theory. It covers stochastic calculus, optimization techniques and models to analyze advanced issues in the multi-period portfolio theory, the arbitrage pricing theory, term structure of interest rates and the multi-period asset pricing theory.

FIN514 Empirical Methods in Finance [재무실증 연구]

This course covers econometric methods used in finance and recent developments in empirical research in finance.

ACT501 Financial Accounting and Reporting Theory [재무회계이론]

This course introduces financial reporting practices and financial accounting standards including IFRS (International Financial Reporting Standards) and US and Korean Accounting Standards. In addition, financial accounting theory will be discussed.

ACT503 Auditing Theory & Practice [회계 감사 이론과 실제]

This course introduces and discusses contemporary auditing practices and theories. The discussion will focus predominantly on computerized auditing and audit of High Tech and Energy companies. GAAS (Generally Accepted Auditing Standards) of US and Korea will be examined.

ACT504 Contemporary Issues in Accounting [현대회계이론]

This course will address contemporary issues in accounting such as IFRS, Balanced Scorecard, Strategic Cost Management, and Top Executive Compensation.

ACT512 Accounting Information Systems [회계정보시스템]

This course aims to provide a comprehensive understanding of the theoretical and practical applications of current information technology for accounting. Topics include the analysis and design of accounting information systems, accounting databases, and IS control and computerized auditing.

ACT513 Research Methodology in Accounting [재무회계 연구방법론]

This course introduces and explores Research Methodologies in Accounting: Empirical, Archival, and Behavioral. Students will be expected to replicate major research papers using modified data sets.

FIN551 Special Topics in FIA I [FIA 특론 I]

This course introduces graduate students with current and special topics in Finance/ Accounting.

FIN552 Special Topics in FIA II [FIA 특론 II]

This course introduces graduate students with current and special topics in Finance/ Accounting.

ACT502 Special Topics in FIA III [FIA 특론 III]

This course introduces graduate students with current and special topics in Finance/ Accounting.

ACT511 Special Topics in FIA Ⅳ [FIA 특론 Ⅳ]

This course introduces graduate students with current and special topics in Finance/ Accounting.

ACT551 Special Topics in FIA Ⅴ [FIA 특론 Ⅴ]

This course introduces graduate students with current and special topics in Finance/ Accounting.

2014 Course Catalog
Graduate School of Technology Management

Graduate School of Technology Management

1. Introduction

The Graduate School of Technology Management (hereafter GSTM) trains students in the areas of technology management, technology strategy and marketing. Whoever completes all the courses of each program will be granted with PSM(Professional Science Master's) Degree, which does not require any thesis or paper. The GSTM develops graduate programs such as Energy Commodity Trading & Financial Engineering and Business Analytics.

2. Professional Science Master's(PSM) Programs

□ Program Introduction

▶ Energy Commodity Trading & Financial Engineering (ECTFE)

The Energy Commodity Trading & Financial Engineering program sets out to train students to anticipate factors affecting commodity crisis. The program will give students the knowledge and skills required to become a highly qualified trader in energy commodity fields such as international finance, financial risk management, supply chain management, derivative accounting, etc. The Energy Commodity Trading & Financial Engineering program will be of value for students who wish to become an expert in the financial management of energy firms, energy industry capital projects, energy trading and risk management.

▶ Business Analytics (BA)

Students in the Business Analytics program are trained for careers within companies of various fields, which require analyzing skill as well as academia. By focusing on the training of students within the areas of statistics, analytics programming and data mining, students attain an ability to analyze and deal with big data. The program offers students mandatory courses such as Marketing Research and Information Management which cover the fundamentals of management as well as project courses, such as Capstone Project, Business Analytics Practicum and Topics in Business Analytics. The courses will help students gain insight into global issues echoing the digitalization of data.

Credit Requirement

Program	Total Credits
Energy Commodity Trading & Financial Engineering	at least 45 credits
Business Analytics	at least 45 credits

Curriculum

▶ Energy Commodity Trading & Financial Engineering (ECTFE)

Course is	Course No.	Course Title	C-L-E	Remark
Required	ECT511	Financial Mathematics	3-3-0	
	ECT515	Investments	3-3-0	
	ECT516	Derivative Markets	3-3-0	
	ECT519	Financial Management	3-3-0	
	ECT523	International Finance	3-3-0	
	ECT551	Trading Project/Practice I	3-3-0	
	ECT552	Trading Project/Practice II	3-3-0	
	MGT521	Business Ethics	1-1-0	
Elective	ECT514	Computational Methods in Finance	3-3-0	
	ECT517	Quantitative Risk Management	3-3-0	
	ECT518	Financial Engineering	3-3-0	
	ECT520	Financial Accounting	3-3-0	
	ECT521	Energy Markets & Pricing	3-3-0	
	ECT522	Energy Chemical & Logistics	3-3-0	
	ECT524	Quantitative Methods in Finance	3-3-0	
	ECT525	Energy Strategy	3-3-0	
	ECT526	Market Microstructure	3-3-0	
	ECT527	FICC Market and Analysis	3-3-0	
	ECT691	Market Investigation	2-0-4	
	ECT692	Market Analysis	2-0-4	
	ECT693	Financial Modeling	2-0-4	
	ECT694	Capstone Project	2-0-4	
	ECT561	Internship	-	

▶ Business Analytics (BA)

Course is	Course No.	Course Title	C-L-E	Remark
Elective	BAT501	Analytics Management	3-3-0	
	BAT511	Introduction to Data Mining	3-3-0	
	BAT512	Advanced Techniques for Data Mining	3-3-0	
	BAT513	Advanced Statistics	3-3-0	
	BAT514	Business Modeling and Decision Making	3-3-0	
	BAT515	Analytics Programming	3-3-0	
	BAT516	Database Management	3-3-0	
	BAT517	BPM and Process Mining	3-3-0	
	BAT521	Marketing Research	3-3-0	
	BAT522	Customer Analytics	3-3-0	
	BAT523	Decision Making in Strategic Management	3-3-0	
	BAT524	Information Management	3-3-0	
	BAT525	Management Science	3-3-0	
	BAT526	Topics in Business Analytics	3-3-0	
	BAT551	Business Analytics Practicum	2-2-0	
	BAT561	Capstone Project	3-0-6	

□ Course Description

▶ Energy Commodity Trading & Financial Engineering (ECTFE)

ECT511 Financial Mathematics

In this course students will review and study mathematical concepts and methods which are essentially used in the field of financial engineering. The topics of this course include single and multivariable calculus, linear algebra, differential equations and numerical computation methods, and applications to option pricing models such as Black-Scholes model.

ECT514 Computational Methods in Finance

This course emphasizes numerical implementation of the option pricing models. Major topics include finite-difference methods, trees and lattices and Monte Carlo simulations with extensions. In addition to the basic pricing models, the course covers portfolio optimization methods and statistical methods or calibration of the parameters.

ECT515 Investments

This course introduces the basic principles in investments such as diversification, no arbitrage principle for security valuation, equilibrium asset pricing models such as CAPM, and factor models. This course further investigates fundamental valuation for commodities, fixed income securities, and contingent claims.

ECT516 Derivative Markets

This course introduces the basic features of futures and options. The course elaborates several approaches of pricing derivative securities such as binomial and trinomial option pricing, Black-Scholes formula, implied binomial trees. In addition, this course focuses on trading strategies of futures and options.

ECT517 Quantitative Risk Management

The course investigates core principles of risk management, particularly market and credit risk management using Value at Risk (VaR) and introduces other recent risk management tools.

ECT518 Financial Engineering

This course is for the student who is interested in modeling the derivatives. The general quantitative finance will be excluding mathematical proofs. All the theoretic explanation will be implemented with the Microsoft Excel for the practical uses the class.

ECT519 Financial Management

This course introduces two main financial decisions of firm managers: capital budgeting and capital structure. Then we learn how to raise funds to invest in positive NPV projects via equity and debt financing. We finally learn some approaches to improve the value of corporations by improving corporate governance and implementing restructuring or mergers and acquisitions.

ECT520 Financial Accounting

This course introduces basic accounting theories, concepts, and the structure of financial statements. The course also discusses about how to perform the analysis of financial information to evaluate the profitability, liquidity and financial stability of a company. In particular, a brief introduction of hedging transactions and related accounting rules will be provided in this course.

ECT521 Energy Markets & Pricing

This module provides the fundamental knowledge of international energy market and pricing methodologies. The aim of the module is to help students understand complexity of energy market formed by various micro and macro economic factors. In addition, this module will also allow students to understand how crude oil prices decided in different geographic markets such as Europe, US, and Asia.

ECT522 Energy Chemical & Logistics

This module will equip students with the tools necessary to think skillfully and maturely, but also independently on matters relating to the commercial oil and energy business. Students will also learn about the different types of energy chemical and how to handle those energies effectively.

ECT523 International Finance

This module analyzes various issues that arise in an international corporate environment. The course covers topics such as : international and locational arbitrage strategies ; exchange rate determination theories and forecasting; exchange risk management; international portfolio; and MNC's financial structure, cost of capital and sources of finance.

ECT524 Quantitative Methods in Finance

This course introduces probability theory and basic statistics, regression analysis and multivariate analysis. This course also introduces the concepts and tools of stochastic calculus required for effective pricing of complex financial derivatives in discrete and continuous time.

ECT525 Energy Strategy

This course introduces the strategic decision making related to the energy policy including production, distribution and consumption. The strategy can be applied to oil supply and demand as well as alternative energy sources. The lecture will be provided with theories and several cases.

ECT526 Market Microstructure

This course is designed to introduce the trading behavior. Students are going to understand various structures of trading and exchanges including prices, quotes, transactions and volume which is made by traders, brokers and investors. They can be applied to an algorithmic trading or DMA as well.

ECT527 FICC Market & Analysis

This course is designed to introduce FICC market including fixed income, currency and commodity. Students are going to understand the time value of money and the relation between price and yield. 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.

ECT551 Trading Project/Practice I

This module will prepare students for a career in the oil and gas industry. The course commences with an introduction to energy market pricing and industry practices within an energy trading environment. Students will learn how a trading company operates and will become familiar with the standard operating protocol of a trading company. Students will practice these skills in real world trading simulation.

ECT552 Trading Project/Practice II

This module builds on the knowledge acquired in module 1(ECT551 Trading Project/Practice I). The Trading Project/Practice 2 will be a more advance trading simulation project. The module will begin with the progress of a trade, from verbal agreement between two traders, through the subsequent preparation of a contract, operation of a contract with chartering, nomination of a tanker, invoicing and presentation of documents, and the settlement of claims.

ECT691 Market Investigation

In this course, students will investigate historical movement and current status on a selected financial market with their related news.

ECT692 Market Analysis

In this course, students will read reports on a selected financial market written by analysts working on several financial institutions and make their own reports.

ECT693 Financial Modeling

In this course, students will compose their own financial model with several financial instruments including financial derivatives. Their own model will be implemented by computer programming.

ECT694 Capstone Project

In this course, students will simulate their own selected role in the financial market. They can choose dealer, quants, analyst or sales as their role.

ECT561 Internship

Students will work for commodity trading desks (front, middle, and back offices) in the petroleum companies, banks, and trading firms. They will learn entry-level knowledge and practices to become traders, risk managers, and analysts.

MGT521 Business Ethics

The purpose of this course is to enable students to reason about the role of ethics in trading and contracting in the energy commodity trading and financial market. In the course, students will participate in a series of case study discussions, focusing on analyzing the issues in moral terms and then making decisions and developing a set of reasons why the decision can ethically justified. During the discussion, additionally, students will think about the impact of their financial transactions on stakeholders and societies.

▶ Business Analytics (BA)

BAT501 Analytics Management

This course is to help a student to understand what business analytics is about, how it can help managers to make better decisions and an organization perform better, and what kind of capabilities need to be addressed for an organization to be analytical. It also describes 5 success factors (data, enterprise, leadership, targets, and analysts) for analytical capability and the best way to strengthen them.

BAT511 Introduction to Data Mining

Data mining is the process of discovering new patterns from large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics and database systems. The basic data mining techniques and their use in a business context will be addressed. Furthermore, an advanced topic in data mining (i.e. process mining) will also discussed in the class.

BAT512 Advanced Techniques for Data Mining

Advanced data mining is the process of discovering new patterns from large data sets involving methods at the intersection of artificial intelligence, machine learning, statistics and database systems. The Advanced data mining techniques and their use in a business context will be addressed.

BAT513 Advanced Statistics

This course will provide students with analytical and decision making skills through a variety of topics in statistics and optimization modeling. Underlying theory for statistical analysis and its business applications will be emphasized. This helps students evaluate and handle business situations with statistics in mind. As a result, students will be well prepared to describe and analyze data for decision makings in business fields such as marketing, operations, and finance.

BAT514 Business Modeling and Decision Making

This course will enable students to build deterministic and probabilistic models of business problems that lead to making better managerial decisions. Students will acquire the necessary skills to analyze complex business situations, develop mathematical models of those situations, explore and prioritize alternative solutions through formalized approaches, and do "what if?" sensitivity analysis to gain insight into why the chosen solution makes business sense. Among the topics covered will be linear and integer programming, dynamic programming, non-linear optimization, Monte Carlo simulation, decision analysis and utility theory, and multi-criteria decision making.

BAT515 Analytics Programming

This course aims to teach students programming techniques for managing, and summarizing data, and reporting results.

BAT516 Database Management

This course is an introduction to database systems that manage very large amounts of data.One of the popular approaches in database management is relational model, which uses a two-dimensional table as its primary structure.The relational model underlies the major commercial database systems. We cover relational design using the ER (Entity-Relationship) model and UML (Unified Modeling Language), and SQL (Structured Query Language), the standard query language for relational databases, will be learned and experienced. Another focus of this course will be data preparation for further business analytics. It includes the use of SQL along with statistical and data mining tool (e.g., SAS) and multi-dimensional data extraction from data warehouse.

BAT517 BPM and Process Mining

BPM/Process Mining course focuses on so-called "process-aware" information systems. The first part of the course focuses on the modeling and implementation of BPM (Business Process Management). Different languages and systems are presented. Emphasis is on the control-flow and resource perspective. The second part of the course focuses on the analysis of workflows/business processes. Different types of analysis such as business process simulation, workflow verification, etc. will be considered. Furthermore, this course teaches students the theoretical foundations of process mining and exposes students to real-life data sets to understand challenges related to process discovery, conformance checking, and model extension.

BAT521 Marketing Research

While the course provides insight into how to actually conduct research, its focus is on providing the needed background knowledge for future managers who will be the ultimate users of the data, and who will determine the scope and direction of research conducted. Market analytics is a particularly valuable skill set for students planning careers in consulting, marketing, or as entrepreneurs, and is a fundamental function in industries like consumer packaged goods, financial services, pharmaceuticals and retail management.

BAT522 Customer Analytics

Customer analytics allow for ways to test new products, identifying customer needs, design promotion and advertising campaign and execute overall marketing strategy. Particular emphasis is placed on understanding of the core psychological processes of decision making by consumer, and customer’s environment for segmentation of markets.

BAT523 Decision Making in Strategic Management

Firms’ allocation of funds, resources, and time for competitive advantage should be aligned with their strategy. This course focuses on analytic methods for strategic decision making. At different levels of strategic management, various analytic methods will be introduced with examples and case studies. This course also covers basic contents of strategic management to help students understand the analytic methods.

BAT524 Information Management

In this course, students will study how information is produced and managed in enterprises. Main topics discussed include: the principles of information management; information management technologies; techniques to analyze information needs and use; and the social and ethical context of information management.

BAT525 Management Science

This course develops fundamental knowledge and skills for applying advanced analytical methods to help make better decisions. By using techniques such as mathematical modeling to analyze complex situations, students will learn how to make more effective decision and build more productive systems based on the intelligent use of data. Topics include optimization, statistics, forecasting, and probabilistic analysis.

BAT526 Topics in Business Analytics

This course will provide students with an opportunity to study how Business Analytics knowledge and techniques are applied in various fields. Possible topics include: Financial Analytics, Web Analytics, Healthcare Analytics, Text Mining, Social Analytics, and so on.

BAT551 Business Analytics Practicum

In this course, students will not only have a chance to hear from CEOs, but also learn analytics-related techniques, such as data visualization, presentation skills, and consulting skills.

BAT561 Capstone Project

In order for an opportunity to apply their learning to a real field, students must complete a Capstone Project in collaboration with a company, under the supervision of an appointed advisor. The project scope is decided by discussion with the advisor.