2020 GIST College Academic Handbook

Gwangju Institute of Science and Technology

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Undergraduate Student Research Program

Global Talent Fostering Program

Introduction of GIST College

1. Background of establishment

A. To find and cultivate advanced scientific and technological talents who will take the lead in Korean industries

B. To overcome the limited supply of high-class talents at science and engineering graduate institutions, by discovering and fostering outstanding science prodigies through our undergraduate curricula

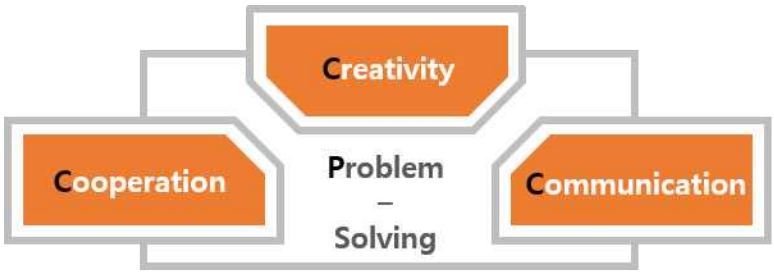
C. To provide a complete and advanced science education system that starts from the undergraduate level and reaches to doctoral and post-doctoral programs

D. The Gwangju Institute of Science and Technology Act, which was created to establish our undergraduate programs, passed in the National Assembly in May 2008

E. The 1st class (of 100 students) was admitted into our undergraduate program in March 2010

2. Educational objectives

Fostering the 21st-century talents equipped with 3C1P* capabilities



*Creativity + Cooperation + Communication + Problem solving

3. Vision

A. Educating talents in the foundations of science and technology to produce globally competitive scientists and engineers

B. Fostering talents equipped with balanced, in-depth knowledge in both science & technology foundations as well as experience in humanities, social sciences and liberal arts education.

4. Operation policies

A. Freshman year: Division of Liberal Arts and Sciences courses / Sophomore to senior year: concentration courses

B. Improving student globalization through English lectures of concentration courses, foreign exchange student programs, and other programs.

C. Offering outstanding students early graduation opportunities
D. Providing undergraduate students the opportunity to participate in graduate level research projects

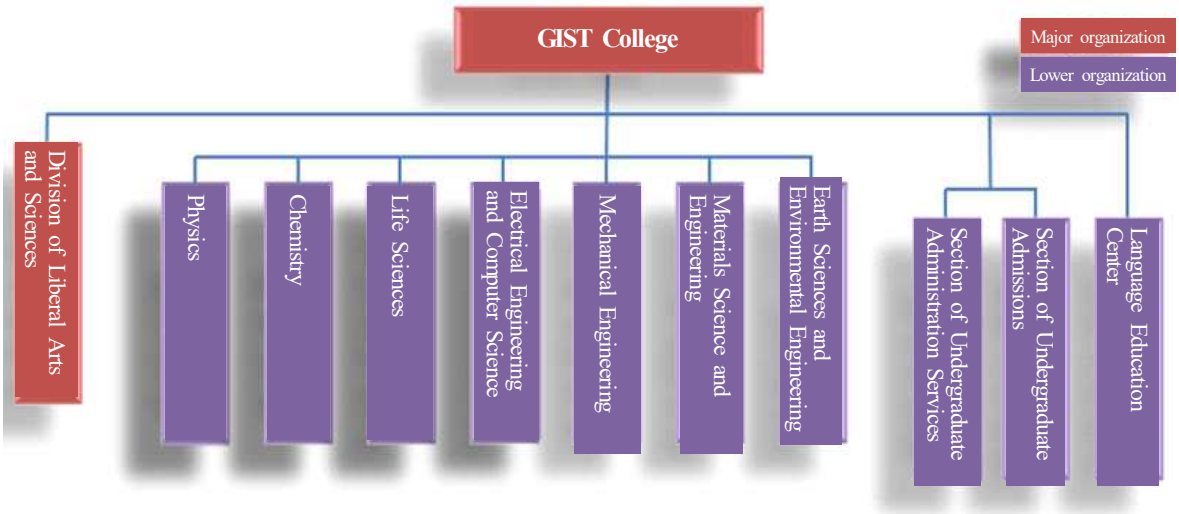
5. Educational characteristics

A. English lectures for all general science concentration courses
B. Small-sized, conversation-style classes
C. Intensive education in the general sciences, reinforced by supplemental experimentation courses and recitations (similar to the style of Caltech)
D. Strengthening students' sources of creativity by providing courses in humanities and social sciences, as well as art, music and physical education
E. 1:1 customized guidance and counseling system

6. Education units

A. Liberal studies in freshman year: Division of Liberal Arts and Sciences
B. Concentration courses available from sophomore year: Physics, Chemistry, Life Sciences, Electrical Engineering and Computer Science, Mechanical Engineering, Materials Science and Engineering, Earth Sciences and Environmental Engineering

※ Available Minors: Mathematics, Humanities and Social Sciences, Energy, Biomedical Engineering, Culture Technology, Intelligent Robotics.



Academic Guide

1. General academics

A. Credit requirements for undergraduate programs

To graduate from an undergraduate program, the requirements are a minimum of 130 credits with a minimum cumulative grade point average of 2.0 out of 4.5 for all courses completed.

※ Details of graduation requirements as specified in 5. Completion of courses of Division of Liberal Arts and Sciences, 8. Completion of concentration curriculum courses, and 10. Graduation requirements of the Academic Guide should be fully understood.

B. School year, number of class days and off-days

1) School year

A) A GIST school year runs from March 1 to the last day of February of the following year.

This one school year is divided into two semesters as follows:

(1) 1st semester: from March 1 to August 31

(2) 2nd semester: September 1 to the last day of February of the following year

※ Some adjustments may be made according to the circumstances of the semester

B) GIST President may open seasonal semesters (summer semester or winter semester) during vacation periods.

2) Number of class weeks

The sum of the number of class weeks in the 1st semester and the 2nd semester total 32 weeks or longer depending on scheduling circumstances.

3) Days with no classes: Fixed days with no classes are as follows:

A) National holidays

B) GIST Foundation anniversary (November 17)

C) Summer vacation

D) Winter vacation

C. Limits on number of school years and enrollment terms

1) The typical number of school years to complete an undergraduate program is four years. However, for those who in advance obtain the credits required for the conferment of undergraduate degrees, the term may be shortened. This is in accordance with the shortening of school years regulation as specified in the Higher Education Act for confering undergraduate degrees.

2) The total terms of enrollment during an undergraduate program must not exceed 12 terms or six years. However, a period in which a leave of absence was taken is not be included in the total terms of enrollment. Those who do not complete the full curriculum within the maximum number of enrollment terms are subject to expulsion.

3) Those who enroll in an undergraduate program for an excess of 8 terms or four years, which is the typical number enrollment terms or school years, must pay all of the additional necessary educational expenses and fees.

D. Classification of Student Year

1) The year of enrolled students shall be classified based on the number of completed semesters and acquired credits as follows:
   A) Freshman: Until the acquisition of 33 credits
   B) Sophomore: Until the completion of at least two semesters and the acquisition of 66 credits
   C) Junior: Until the completion of at least four semesters and the acquisition of 99 credits;
   D) Senior: In the seventh or later semester with at least 100 credits acquired;
2) A bachelor's program student who has acquired the course credits prescribed in t he above section 1) shall be deemed to have completed that particular grade.

E. Concentrations and minors

1) A minimum of 36 concentration credits (30 for Materials Science and Engineering concentration) are required for graduation, and a maximum of 42 credits will be accepted as graduation credits.
2) In addition to the major concentration, the completion of a minor will be recognized if necessary conditions, including a minimum required 15 credits or more for the particular minor, are satisfied.

2. Curricular structure

A. Basic direction of curriculum

The GIST college curriculum includes a solid intensive education of basic knowledge in science and engineering as well as a broad liberal arts education. Subsequently, GIST College seeks 3C1P - Creativity, Cooperation, Communication and Problem solving - as its primary educational objective. The collective purpose of these educational goals is to cultivate creative science and engineering experts that for understand the values and traditions of human society.

The curriculum of GIST College was formed in accordance with Article 33 of the School Regulations (Formation of curriculum), and various matters proposed in this curriculum can effectivley be applied as auxiliary school regulations regarding the completion of courses.

B. Classification and composition of curriculum

The curriculum of GIST undergraduate programs is classified into Liberal Arts, Gen eral Sciences and concentrations, and common courses, which are further divided into required courses and electives. However, in addition to these courses, free electives and research courses may be taken.

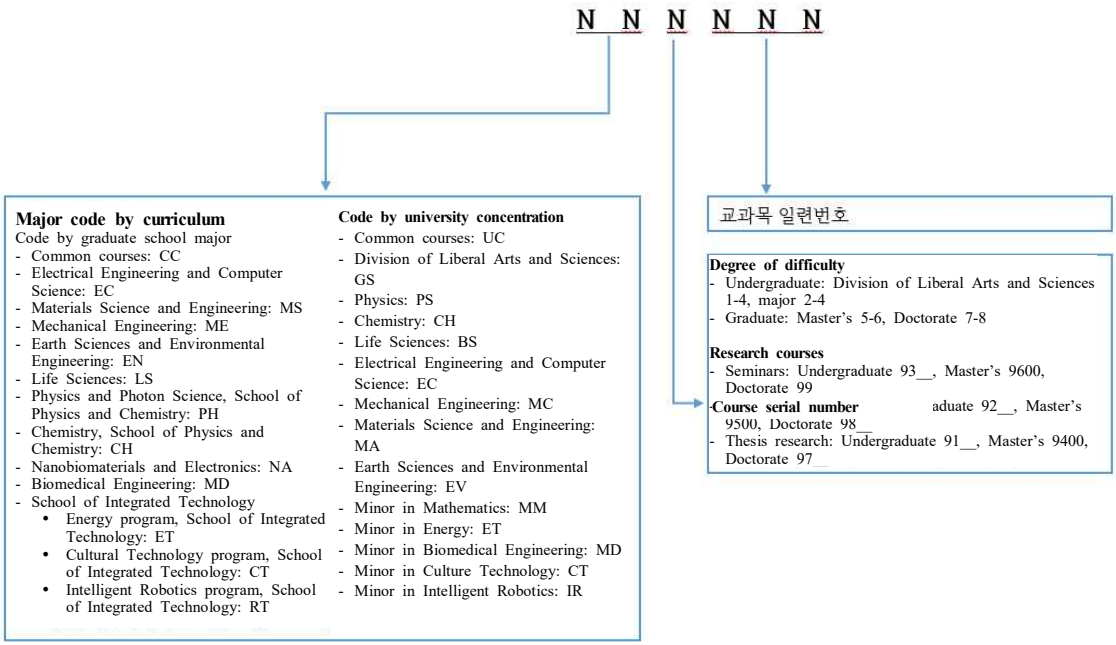
Each curriculum is classified as follows:

1) <Liberal arts> courses are classified into Basics of Language, Humanities and Social Sciences [HUS/PPE/GSC], Software, Practical Arts and Physical Education, and Special Programs.
2) <General> courses are classified into General Sciences and Experiment courses

operated by the Division of Liberal Arts and Sciences.

3) <Concentration> courses refer to required courses and electives operated by the concentrations of Physics, Chemistry, Life Sciences, Electrical Engineering and Computer Science, Mechanical Engineering, Materials Science and Engineering and Earth Sciences and Environmental Engineering.
4) <Common> courses refer to those operated as common courses by GIST College regardless of the area of concentration including science and technology, economy, community service, cultivation of creativity, etc.
5) <Free electives> refer to courses from other concentrations and graduate schools as well as all courses [e.g. General Sciences, Liberal Arts] completed in addition to the required courses (credits) in general and liberal arts courses.
6) <Research> courses are divided into Thesis Research, Thesis Research Substitute courses and Seminars.

C. Expression of course codes: The course codes are defined as follows:



3. Course registration

A. Course registration procedure and deadline

1) Course registration, change, cancellation

a) For each semester, students should select courses to be completed and register for those courses within the course registration period under the guidance of their academic adviser. For courses in general sciences that are available both in the 1st and 2nd semesters, students should first consult with the relevant professors for each course to take into consideration students outside of their applicable concentration. Then, the students can choose and register for the courses under the guidance of their academic adviser.

b) Between 11 to 21 credits must be completed every semester.

※ However, if a student has declared a minor and holds an average GPA of higher than 3.0 in the previous semester, it is possible to register for courses totalling up to 24 credits under approval of an academic adviser.

※ If the minimum number of credits are not completed, the scholoarship-tuition assistance, meal allowance and similar support for the following semester will be limited.

c) A student who wishes to change courses for which he/she has already registered must submit a request for change of registered courses to the Section of Undergraduate Administration Services within two weeks of the first day of class.

d) If a student passes the 2-week period (one week for seasonal winter/summer semesters) and wishes to cancel a registered course within the first seven weeks (two weeks for seasonal semesters), he/she must submit a request for cancellation of registered courses to the Section of Undergraduate Administration Services.

e) The course for which a request for cancellation of registered courses is submitted is marked with W on their transcript and will not be included in the calculation of GPA.

f) A student who fails to register for courses without a justifiable reason will be expelled.

g) Course registration of summer semesters and Study-Abroad Programs at foreign universities should also be performed under the guidance of an academic adviser.

h) If a course of another program (outside of division, concentrations) is to be taken, the grade declaration method may be selected after receiving approval from an academic adviser. If the grading method (A+, A0 to F) is selected, the final grade will be reflected in the GPA and, if the pass/fail method (S, U) is selected, the credits for completion are accepted but will not be reflected in the GPA. However, **this does not apply to courses opened in the t he Division of Liberal Arts and Sciences.** Also, **concentrations to which a student belongs (i.e. undergraduate program, department) and courses students take from other concentrations (i.e. undergraduate program, department) that are opened as double codes cannot be registered via the pass/fail method (S, U).**
During enrollment, the selection of the pass/fail grading method is **limited to 12 credits for the undergraduate curriculum** and 9 credits for the integrated master's and doctorate curriculum**.** Pass (S) is given only as a grade if it corresponds to a grade higher than C+ and the pass result (S, U) and the grade level may be shown together.

B. Retaking courses

1) Any course that has been completed and meets the following critera may be retaken.
2) A course retake may be applied only if the grade of the registered course is C^0 or lower.
3) If the grade of a required course among the registered courses is F or U, it must be retaken to obtain credits.
4) When obtaining credits by retaking a course, the originally obtained grade is changed to R and the final grade is marked along with "*" in the semester in which the course was retaken. The GPA is calculated with the grade of the semester in which the course was retaken.
5) The grade of a retaken course cannot exceed B+ and, if the retaken course grade is lower, the GPA is calculated with the originally obtained grade and the grade of the semester in which the course was retaken is marked as R.

C. Course registration restrictions

1) Qualifications of course registration: In principle, the restriction in the capacity of course registration will follow a first-come, first-served, computer based stude nt registration method, and an academic adviser may specify the capacity of the courses students are permitted to enroll in.

4. Declaration of concentrations and minors

A. Declaration of concentrations

1) Qualifications to declare a concentration
   a) Starting from the the entering Class of 2018: Those who have registered for 2 or more regular semesters or acquired 30 or more credits in total.
      ※ The aforementioned 2 regular semesters do not include seasonal semesters.
      ※ The aforementioned 30 credits include those recognized in accordance with Article 39 of the School Regulations (Acknowledgement of credits obtained in other universities).
2) Deadline for concentration declaration: June 10 or December 10
3) Concentration declaration process: Online registration within the specified period in accordance with the concentration declaration announcement given each semester
   ※ Zeus--program -Location for concentration declaration.
4) Concentration capacity: Declaration is operated without capacity restriction in each concentration by respecting student's autonomy in concentration selection

B. Change in concentration: One semester after the declaration of a concentration, an application for change of concentration can be submitted during the concentration declaration announcement period each semester.

※ **2 or more regular semesters must** be **completed after** the final **declaration of** concentration**.**

C. Declaration of minor or double concentration (*further details in section 7.G.)

1) Qualifications to declare a minor

a) Starting from the the entering Class of 2018: Those who have registered for 2 or more regular semesters or whose GPA is 2.5 or higher

2) Deadline for declaration of minor: March 15 or September 15

D. Cancellation of minor or double concentration declaration: A cancellation application must be submitted during the declaration announcement period in each semester

5. Completion of General Science and Liberal Arts credits

A. General Sciences

- The following required course credits in each field must be completed
- Lectures: 3 credits, Experiment courses: 1 credit

<table>
<tr><th colspan="2">Field</th><th>Course title</th><th>Required Credits</th><th>Remark</th></tr>
<tr><td colspan="2" rowspan="2">Mathematics</td><td>Single Variable Calculus and Applications or
Single Variable Calculus & Applications - Honors</td><td>3</td><td></td></tr>
<tr><td>Multivariable Calculus & Applications or
Differential Equations & Applications or
Introduction to Linear Algebra & Applications or
Fundamental Differential Equations with Linear Algebra and Applications</td><td>3</td><td>Required to select 1 of the 4 courses</td></tr>
<tr><td rowspan="4">General Sciences (lecture)</td><td>Physics</td><td>General Physics and Recitation I or
General Physics and Recitation I - Honors</td><td rowspan="4">9</td><td rowspan="4">Required to select 3 areas among Physics, Chemistry, Life Sciences and Electrical Engineering and Computer Science
※ In case all 4 courses are completed, 1 course is acknowledged as a General Sciences elective (free elective) course
※ Lecture courses can be taken befor e the experiment course</td></tr>
<tr><td>Chemistry</td><td>General Chemistry and Recitation I or
General Chemistry and Recitation I - Honors</td></tr>
<tr><td>Life Sciences</td><td>Biology or
Human Biology or
General Biology - Honors</td></tr>
<tr><td>Electrical Engineering and Computer Science</td><td>Computer Programming</td></tr>
<tr><td rowspan="3">General Sciences (experim ent)</td><td>Physics</td><td>General Physics Experiment I</td><td rowspan="3">2-3</td><td rowspan="3">Required to select 2-3 or more courses among Physics, Chemistry and Life Sciences
※ Each experiment course is a co-requisite or pre-requisite with their respective lectures.(e.g. General Physics and Recitation I and General Physics Experiment I)
※ There is no associated experiment course for an Electrical Engineering and Computer Science lecture</td></tr>
<tr><td>Chemistry</td><td>General Chemistry Experiment I</td></tr>
<tr><td>Life Sciences</td><td>General Biology Laboratory</td></tr>
<tr><td colspan="3">Total</td><td>17-18</td><td></td></tr>
</table>

※ An experiment course must be taken either after completing or simultaneously with a lecture course.

※ All excess credits are recognized as “Free electives - General Sciences elective” credits

B. Language

The following required course credits in each language field (7 credits) must be completed.

Field	Category	Course Title		Credits	Remark
English	Required	English Ⅰ: Study Skills for Freshman or English Ⅰ: Presentation and Discussion		2	Required to complete 4 credits or more
	Required	English II: Introduction to Academic Writing in Science and Engineering		2	
Writing in Korean	Required	Writing I	Logical Writing	3	Required to select 1 of 6 courses ※ However, the 3 courses of Writing I and the 3 courses of Writing II are regarded as same courses ※ Students who take a "Writing I" course may take a "Writing II" course additionally
			Academic Writing		
			Creative Writing		
		Writing II	Writing about Science		
			Reading the Classics & Writing		
			Critical Writing		

1) English Courses

a) Students can choose to take either Study Skills for Freshman (GS1601) or Presentation and Discussion (GS1603) in order to meet their English I requirement.

b) The pre-requisite for <English 2> Introduction to Academic Writing in Science and Engineering (GS2652) is either English I course.

2) English Elective Courses

Course code	Course Title	Credits	Comments
GS1605	Practical English Discourse	2	These courses do not fulfill English II requirement.
GS1606	Research Reading in English	2	
GS2651	Debate and Argumentation for Scientists	2	These courses have pre-requisites.
GS2653	Research Ethics: R&D (Reading & Discussion)	2	
GS2654	Creative Expression in English	2	
GS2655	Journalism and News Reporting in the Digital Age	2	
GS3651	<English 3> Undergraduate Research Writing in Science and Engineering	2	

3) English Exemption Criteria

a) <English 1> course exemption

- TOEFL iBT 90, New TEPS 350, IELTS 6.5 or more
- AND pass an exemption test given by LEC

b) <English 2> course exemption

- TOEFL iBT 110, IELTS 8.0 or more
- AND completion of an English elective course (except for those with the course code starting 16##, GS1605 and GS1606)

c) Validity: TOEFL iBT, New TEPS and IELTS scores must be dated within the past 2 years.

d) Submission deadline: English scores must be submitted by the 2nd week of a student's first semester (Sept or Mar).

e) Contact: LEC, College B 102, ☎ 062-715-3703

4) Korean Courses

a) Korean Language courses (Required for graduation, for Int'l students only)

Course code	Course Title	Credits	Comments
GS1902	Basic Korean	0	At least one course is required for graduation
GS1903	Beginner Korean 1	0	
GS1904	Beginner Korean 2	0	
GS1905	Intermediate Korean	0	
GS1906	Practical Korean Vocabulary	0	

- Students are required to take a Korean Proficiency Test before registering for courses.
- At least one (1) of these courses is required for graduation.

b) Other Korean Courses (Int'l students only)

Electives in Humanities and Social Science (Korean Courses)	Classification	Course Title	Credits	Comments
	HUS Course Code: TBA	Understanding Korean Culture	3	6 credits of HUS required for graduation
	HUS Course Code: TBA	History of Hangeul	3	

- Students are required to take 6 credits of HUS courses in order to meet graduation requirements. Students can choose other HUS courses not listed here. Please refer to course list to see more HUS course options.
- International students are encouraged to take <Basic Korean, GS1902> before taking Understanding Korean Culture and History of Hangeul.

c) Korean Exemption Criteria

- Students can exempt out of <Basic Korean, GS1902> OR <Beginner Korean 1, GS2903> by passing a Korean proficiency test held by LEC's Korean Instructor.
- Contact: LEC, College B 102, ☎ 062-715-3703

C. Humanities and Social Sciences

- Each course in Humanities and Social Sciences is classified into three areas: HUS, PPE and GSC
- Students are required to take **24 credits from Humanities and Social Sciences. 6 credits of HUS and 6 credits of PPE must be included.**

※ The credits completed in excess of the requirement(24), additional 12 credits may be acknowledged as "free elective credits"

- Classification of each curricular area: Refer to "Curriculum - Division of Liberal Arts and Sciences"

D. Software requirement: Software Basics and Coding (2 credits)

- Those who having completed "Computer Programming (GS1401)" are exempt (excluded)
- "Software Basics and Coding (GS1490)" cannot be completed after completing "Computer Programming"

E. Seminar for freshman (GIST 101)

1) "GIST 101" is 1 credit course that is only offered in Spring semester. Int'l students must enroll during the 2nd semester of their freshman year
2) From the 2020 Fall semester, students are strongly recommended to take "GIST 102" which is a course to introduce the concentrations and minors available for u ndergraduate students.

F. Free electives

※ For conditions for completion of free electives, refer to the details of each class under "Curriculum requirements"

G. "Arts & Music" and Sports

1) 2 courses of Sports and 2 courses of Arts & Music must be completed
2) up to 4 semesters of each fields are offered free of charge
3) Musical instruments (ex. Clarinet, Violin, Electric guitar, Cello, Flute) are available to share
4) There will be additional fees depending on the sports courses. Some of these courses will be held off-campus. Please check the schedule for details.

H. GIST College Colloquium: 2 courses must be completed

These are no-credit, required courses operated for students' understanding of major

curricula in various majors, and two semesters of these courses must be completed in the period between sophomore year and graduation

※ Grades are assigned as either Pass (S) or Fail (U) and the particular course is considered as completed only if an “S” is acquired

6. Course division by general course level

A. Overview

Course	Course title	Class division	Class exemption and acceptance
Mathe -matics	All courses in Mathematics (Single Variable Calculus & Applications, Multivariable Calculus & Applications, Single Variable Calculus & Applications - Honors, Differential Equations & Applications, Introduction to Linear Algebra & Applications)	Implemented	Implemented[1)]
Physics	General Physics and Recitation I, General Physics and Recitation II, General Physics and Recitation I – Honors, General Physics and Recitation II - Honors	Implemented	Implemented[2)]
Chemistry	General Chemistry and Recitation I, General Chemistry and Recitation II, General Chemistry and Recitation I – Honors, General Chemistry and Recitation II - Honors	Implemented	Implemented[3)]
Life Sciences	Biology, Human Biology, General Biology - Honors	Implemented	Implemented
English	All courses in English (English Ⅰ: Study Skills for Freshmen, English Ⅰ: Presentation and Discussion, English Ⅱ: Introduction to Academic Writing in Science and Engineering)	Implemented	Implemented

B. Course divisions

1) Mathematics, Physics, Chemistry, Life Sciences

a) Classification: Refer to the table above

b) Class division exam: Not implemented

c) Division criteria: Students’ choice (however, a separate exam may be given for enrollment if too many students attempt to take advanced courses)

1) Condition for exemption of Multivariable Calculus & Applications: Those exempt from Single Variable Calculus & Applications only (exemption of Multivariable Calculus & Applications alone is not permitted)

2) Condition for exemption of General Physics and Recitation II: Those exempt from General Physics and Recitation I only (exemption of General Physics and Recitation II alone is not permitted)

3) Condition for exemption of General Chemistry and Recitation II: Those exempt from General Chemistry and Recitation I only (exemption of General Chemistry and Recitation II alone is not permitted)

7. Completion of concentration curriculum courses

A. Concentration definition

Operated as a flexible concept of majors-combined and interdisciplinary education and research

B. Completion of concentration courses:

Required and elective courses for a concentration between 36* and 42 credits (the maximum number of concentration course credits acknowledged for graduation is limited to 42) *30 credits for Materials Science and Engineering concentration

C. Concentration based requirements

※ Credits - Lecture : Experiments : Credits
- 1 credit hour means 1 hour of lecture per week for one semester and 2 hours of experimentation per week for one semester
- e.g. 3:1:3 means 3 lecture hours per week: 2 experiment hours per week: 3 credits

1) Physics

Course No.	Course title	Credits	Remark
PS2101	Classical Mechanics and Recitation Ⅰ	3:1:3	
PS2102	Electromagnetism and Recitation Ⅰ	3:1:3	
PS2103	Electromagnetism and Recitation Ⅱ	3:1:3	
PS3103	Quantum Physics and Recitation I	3:1:3	
PS3104	Quantum Physics and Recitation II	3:1:3	
PS3105	Thermodynamics and Statistical Physics	3:0:3	
PS3106	Experimental Physics I	1:4:3	
PS3107	Mathematical Methods of Physics I	3:0:3	

2) Chemistry

Course No.	Course title	Credits	Remark
CH2101	Analytical Chemistry	3:0:3	
CH2102	Physical Chemistry A	3:0:3	
CH2103	Organic Chemistry Ⅰ	3:0:3	
CH2104	Physical Chemistry B	3:0:3	
CH2105	Synthesis and Analysis of Organic and Inorganic Compounds	1:4:3	
CH3106	Biochemistry Ⅰ	3:0:3	
CH3107	Inorganic Chemistry	3:0:3	

For all classes: “Physical Chemistry I” and “Physical Chemistry B” & “Physical Chemistry II” and “Physical Chemistry A” are identical courses and, thus, are not permitted to be taken one after another.

3) Life Sciences

Course No.	Course title	Credits	Remark
BS2101	Organic Chemistry Ⅰ	3:0:3	
BS2102	Molecular Biology	3:0:3	
BS2103	Biochemistry·Molecular Biology Laboratory	1:4:3	
BS2104	Biochemistry Ⅰ	3:0:3	
BS3101	Biochemistry Ⅱ	3:0:3	
BS3105	Cell Biology	3:0:3	
BS3112	Cell & Developmental Biology Laboratory	1:4:3	

For all classes: "Physical Chemistry Ⅰ" and "Physical Chemistry B" & "Physical Chemistry Ⅱ" and "Physical Chemistry A" are identical courses and, thus, are not permitted to be taken one after another

4) Electrical Engineering and Computer Science

Course No.	Course title	Credits	Remark
EC3101	Electronic Engineering Experiment	1:4:3	Select 1
EC3102	Computer Systems Theory and Experiment	2:4:4	

5) Mechanical Engineering

Course No.	Course title	Credits	Remark
MC2100	Thermodynamics	3:0:3	
MC2101	Solid Mechanics	3:0:3	
MC2102	Fluid Mechanics	3:0:3	
MC2013	Dynamics	3:0:3	
MC3106	Mechanical Engineering Laboratory Ⅰ	1:4:3	
MC3107	Mechanical Engineering Laboratory Ⅱ	1:4:3	

6) Materials Science and Engineering

Course No.	Course title	Credits	Remark
MA2101	Introduction to Materials Science and Engineering	3:0:3	
MA2102	Thermodynamics	3:0:3	
MA2103	Organic Materials Chemistry	3:0:3	
MA2104	Introduction to Polymer Science	3:0:3	
MA3104	Electronic Materials Laboratory	1:4:3	
MA3105	Organic Materials Laboratory	1:4:3	

7) Earth Sciences and Environmental Engineering

Course No.	Course title	Credits	Remark
EV3101	Environmental Engineering	3:0:3	
EV3106	Environmental Laboratory I	1:4:3	
EV3111	Earth Environmentology	3:0:3	
EV4106	Earth and Environmental Transport Phenomena	3:0:3	
EV4107	Environmental Laboratory II	1:4:3	

F. Completion of research courses: 6 credits or more
For the writing of graduation thesis, Undergraduate Thesis Research I and Undergraduate Thesis Research II courses must be completed.

※ Period of enrollment (qualifications) and completion procedure for Undergraduate Thesis Research courses

<table>
<tr><th>Category</th><th>Undergraduate Thesis Research I</th><th>Undergraduate Thesis Research II</th><th>Capstone Design II</th></tr>
<tr><td>Class to which it is applied</td><td>Starting from the entering Class of 2015</td><td>Starting from the entering Class of 2015
※ The entering Class of 2010 through 2014: Undergraduate Thesis Research</td><td>Starting from the entering Class of 2010
※ Limited to Mechanical Engineering</td></tr>
<tr><td>Period in which course can be taken (qualifications)</td><td>- Regular semester: Those who acquire 90 credits or more
- Seasonal semester: It is possible to apply for seasonal enrollment only if one of the following conditions is met
① A student subject to (scheduled) SAP dispatch who is in the 7th or higher semester as of their dispatch semester
② A student who has acquired 90 credits or more and whose GPA is 4.0 or higher</td><td colspan="2">Scheduled semester for graduation
※ Regular semester in which all graduation requirements are (or may be) met</td></tr>
<tr><td>Selection of academic adviser for thesis</td><td>O</td><td>O
※ In principle, the same academic adviser as for Undergraduate Thesis Research I must be chosen</td><td rowspan="7">Following the “Enforcement policies on substitution for undergraduate degree thesis” and the “operation guidelines for Capstone Design course”</td></tr>
<tr><td>Application for Undergraduate Thesis Research</td><td>O</td><td>O</td></tr>
<tr><td>Writing of thesis</td><td>O</td><td>O</td></tr>
<tr><td>Formation of judges</td><td>X</td><td>O</td></tr>
<tr><td>Screening of thesis</td><td>X</td><td>O</td></tr>
<tr><td>Method and completion criteria of grade assessment</td><td>S/U
※ The academic adviser for dissertations will judge based on the degree of completeness of the written thesis</td><td>S/U
※ Judged based on whether or not it has passed the screening by the dissertation review committee</td></tr>
<tr><td>Submission of printed thesis</td><td>X</td><td>O</td></tr>
</table>

G. Minor and double concentration

Category	Double concentration	Minor Concentration
Qualification for declaration	Those who have registered for at least 2 regular semesters (or obtained a total of 30 credits or more) and have a GPA of 2.5 or higher	• Starting with the entering Class of 2018: Those who have completed at least 2 regular semesters and had a GPA 2.5 or higher. • The entering Class of 2010 through 2017: Those who have completed at least 4 regular semesters and had a GPA 2.5 or higher.
Fields	7 Major concentrations (Physics, Chemistry, Life Science, Electrical Engineering and Computer Science, Mechanical Engineering, Materials Science, Earth Sciences and Environmental Engineering)	7 Major concentrations, Liberal Arts and Social Sciences, Mathematics, Biomedical science and Engineering, Energy/Culture/Intelligent Robotics
Declaration/Cancellation Procedure	• Submit application for declaration/cancellation during the notice period for each semester • Until March 15th or September 15th every year	
Completion requirements	• Achieving required courses in relevant field and minimum requirements. • After declaration, you must study for at least 2 regular semesters	• Operation of completion requirements for each field • Students must study at least 1 regular semester after declaration
Remark	• Exemption from writing graduation thesis in the field of double major • Grade display method: Only grade addition method is possible	

8. Art & music and physical education(Sports) courses

A. Classification and conditions for completion of art, music and physical education classes.

1) They are divided into Art & Music, and Sports, and courses may be chosen and taken among the open courses
2) Art & Music and Sports courses are operated as 2-hour, no-credit courses, and 2 semesters must be completed for each.
3) Art & Music and Sports classes' availability may change from one semester to the next considering the students' demand, educational needs, and other factors.
4) Grades of Art, Music and Sports classes are assigned as Pass (S) or Fail (U) and the particular course is considered as completed only if "S" is acquired

※ Tuition for each course in the case of re-enrollment: KRW 120,000

※ The aforementioned tuition for each course must also be paid if additional classes are to be taken after completing all mandatory semesters of art, music and physical education

B. Art & Music and Sports classes

1) Art and music
   - Piano, flute, violin, cello, clarinet, acoustic guitar, electric guitar, bass guitar, drums, vocal, drawing, watercolor painting.
2) Sports
   - Soccer, tennis, basketball, badminton, table tennis, yoga, golf, hip-hop dance, Taekwondo, weight training, futsal, swimming, bowling, baseball.

9. Graduation requirements

A. Academic Course Duration

Standard*	Minimum	Maximum
4 years	3 years	6 years

※ Financial support is limited to 4 years (Article 66 of the School Regulations)

B. A minimum of **130 credits** is required for graduation from a bachelor's program, and the grade point average for all the courses taken must be at least **2.0/4.5.** (Article 68 of the Academic Regulations)

C. Curriculum requirements

Classification			Remark
General science and liberal arts credits	Language	7 credits	- 4 credits of English, 3 credits of Writing in Korean
	Humanities and Social Sciences	24 credits	- Including 6 credits of HUS and 6 credits of PPE
	Software	0-2 credits	- 2 credits of "Software Basics and Coding" required to be completed ※ Those having completed "Computer Programming" are exempt (excluded)
	General Sciences	17-18 credits	- 6 credits of mathematics - 9 of 12 credits in total (3 Physics, 3 Chemistry, 3 Life Sciences, 3 Electrical Engineering and Computer Science) to be selected and completed ※ If the field of Physics, Chemistry or Life Sciences is selected, an experiment course (1 credit each) must be completed
	Seminar for Freshman	1 credit	- Required to be taken during the freshman year (for int'l students 2nd semester since it is offered only in Spring semester)
	Subtotal	49-52 credits	
Concentraion credits	Required	36 ~ 42 credits	- Up to 42 credits are acknowledged for graduation ※ **However,** between **30** and 42 credits for **Materials Science and Engineering Concentration**
	Electives		
Research credits	Undergraduate Thesis Research	6 credits	- Required to complete Undergraduate Thesis Research I (3), Undergraduate Thesis Research II (3) ※ Undergraduate Thesis Research II: Must be completed in the final semester for graduation, and, for Mechanical Engineering concentration, possible to complete "Capstone Design II" as a substitute
Free elective credits	General courses	1 credit or more	- Required to complete 1 credit of "Science, Technology and Economy" - Volunteer Social Service, Overseas Volunteer Service: Even if both courses have been completed, max. 1 credit is acknowledged - Creativity Cultivation: Max. 1 credit acknowledged
	Humanities and Social Sciences	Up to 12 credits	- The credits completed in excess of the required credits (24) for completion in Humanities and Social Sciences, up to 12 credits may be acknowledged in addition
	Language electives	17-38 credits or more	- Credits completed in excess of the required credits for Language (7) and credits of related electives
	General Sciences electives		- Credits completed in excess of the required credits for General Sciences (17-18) and credits completed from electives and basic majors of General Sciences
	Other concentrations		- Credits completed from courses of other concentrations and minors ※ However, credits completed from Liberal Arts and Social Sciences minors are excluded
	Graduate school courses		
	Subtotal	30-39 credits or more	※ However, **30-45 credits or more for Materials Science and Engineering concentration**
Total	130 credits or more		Research credits are acknowledged up to 6 credits only

Classification			Remark
Classification and criteria for completion			
Required, no-credit	Art and Music	2 courses	- 1 course per semester. 2 semesters must be completed - up to 4 semesters of each fields are offered free of charge
	Sports	2 courses	
	Korean language	1 course	
	GIST Colloquium	2 courses	

E. Early graduation

1) Conditions of application for early graduation: Students who have acquired the necessary credits in an undergraduate program and wish to graduate earlier than the typical number of school years (4 years) may apply for early graduation and, in such a case, the term of school year is calculated by including the leave of absence period.
2) Application for early graduation: Application for early graduation is to be written and submitted within 30 days from the first day of class of the scheduled semester for early graduation (application period to be announced separately)
3) Conditions satisfying early graduation: An early graduation is possible if the necessary credits in the undergraduate program are acquired and the GPA is a minimum of 3.5 out of 4.5

10. Yearly management plan for undergraduate + integrated master's and doctorate curriculum

A. Definition of integrated master's + doctorate curriculum

The curriculum through which a holder of a bachelor's degree may acquire a doctorate degree without having to submit a master's dissertation or take a doctorate program entrance exam.

B. Management plan

Category	Term of school year	Term possible to be shortened	Shortest term of enrollment	GIST management policy
Undergraduate curriculum	4 years	1 year	3 years	4 years
Integrated master's + doctorate curriculum	4 years or more	1 year	3 years	4 years
Total	8 years or more	2 years	6 years	8 years

※ It is recommended for students to advance to our graduate school by participating in various research programs including G-SURF and research projects by graduate school professors.

C. Semester in which the doctorate curriculum is recognized for a student in the integrated master's and doctorate curriculum: After the completion of 2 semesters.

Curriculum and Course Overview

1. Division of Liberal Arts and Sciences

A. Overview of Division of Liberal Arts and Sciences

In modern society where the importance of science and technology in the lives of mankind continues to grow day by day, scientists need to shoulder more roles and responsibilities. Students who will be nurtured as professionals in fields of science and technology must also be subjected to ceducational curricula that suits the magnitude of the social roles and responsibilities they will take over. Through our curriculum in the Humanities and Social Sciences field within the Division of Liberal Arts and Sciences, students are expected to equip themselves with the knowledge and characteristics of introspective intellectuals who deeply contemplate the issues of life, both of their own and their neighbors, and strive to improve the ways of human life into something more abundant and worthwhile spiritually and materially.

Thus, students who enter GIST College take classes in the fields of General Sciences, Humanities and Social Sciences, Art, Music and Physical Education for one year in the Division of Liberal Arts and Sciences before starting their concentration curricula. Through courses in the field of General Sciences, our goal is for students to learn the necessary concepts that form the basis for understanding the natural environment and continuous execution of research in the future. These core concepts taught to students encompass everything from those related to natural sciences and engineering to various research methods needed for concentration curricula. Moreover, the concepts also instruct students on modern science trends to enable them to lead the growth and future of science and engineering.

B. Course overview

GS1001 Single Variable Calculus & Applications [3:1:3]

Dealing with calculus of single-variable functions, this course introduces basic concepts and expands into the understanding and application of abstract concepts: The course introduces basic differential equations and deals with contents related to calculus. Students learn the definition of the convergence of an infinite sequence and an infinite series, and learn the properties and applications of functions expressed as infinite series. This is to build concepts of various fundamental topics needed in differential equations, linear algebra and multivariable functions.

GS1011 Single Variable Calculus & Applications – Honors [3:1:3]

This course basically deals with identical topics as GS1001 Single Variable Calculus and Applications. Dealing with calculus of single-variable functions, this course introduces basic concepts and expands into the understanding and application of abstract concepts: The course introduces basic differential equations and deals with contents related to calculus. Students learn the definition of the convergence of an infinite sequence and an infinite series, and learn the properties and applications of functions expressed as infinite series. Compared to GS1001, it adds a greater mathematical strictness and stresses close correlation with applications of science and engineering.

GS1101 General Physics and Recitation I [3:1:3]
In this introduction to classical mechanics and basic thermodynamics, the concepts of space, time, force, momentum, angular momentum, energy, laws of conservation of momentum and energy are introduced. Such fundamental concepts of physics are applied to the dynamics of rigid bodies, central force problems and understanding of the dynamics of ideal gas.

GS1102 General Physics and Recitation Ⅱ [3:1:3]
This course is the introduction to electromagnetism and modern physics. The concepts of charge, Coulomb's law, potential, electric dipole, electrostatic energy and electromagnetic induction phenomenon are introduced, and it also deals with Maxwell's equations, the concept of electromagnetic waves, geometrical optics and wave optics. Moreover, the course introduces the basic concepts of modern physics such as quantum mechanics, condensed matter physics and elementary particle physics.

GS1103 General Physics and Recitation I - Honors [3:1:3]
This course deals with the basic ideas of classical mechanics, classical electromagnetism, special relativity, general relativity and quantum physics. First, the course comprehensively explores the concepts of force, momentum, angular momentum, energy and laws of conservation centered on classical mechanics and electromagnetism. The course also deals with the relation between the principle of least action and Newton's laws and between mathematics and physics. Afterwards, the course considers the concept of time and space and the quantum nature of materials centered on relativity and quantum physics in various angles and studies how the concepts of classical physics are revised accordingly. Such fundamental concepts of physics are applied to central force problems, harmonic oscillator problems and the dynamics of rigid bodies.

GS1104 General Physics and Recitation Ⅱ - Honors [3:1:3]
This course deals with classical electromagnetism more extensively in continuation of General Physics I - Honors. The fundamental concepts of the theory of multivariable functions and vector calculus are learned and the meaning and applications of Maxwell's equations are studied. This naturally leads to optics where various wave phenomena (mechanical, electromagnetic, quantum-mechanical) are examined together. Statistical mechanics centered on the laws of thermodynamics, kinetic theory of gases and entropy is also studied. Lastly, various concepts of modern physics (particle physics, nuclear physics, atomic and molecular physics, condensed matter physics, astrophysics, cosmology) are briefly introduced.

GS1111 General Physics Experiment I [0:2:1]
This course aims to introduce basic physics experiment techniques and general principles of physics through a wide spectrum of experiments. The topics of experiments are related to General Physics and Recitation I (GS1101) and General Physics and Recitation I - Honors (GS1103), and includes wave experiments, thermodynamics experiments, etc. centered on experiments related to classical mechanics (projectile motion, pendulum motion, one-dimensional and two-dimensional collision, etc.). Data analysis and interpretation of experiment results are especially emphasized.

GS1112 General Physics Experiment Ⅱ [0:2:1]
This course aims to introduce basic physics experiment techniques and general principles of physics through a wide spectrum of experiments. The topics of experiments are related to General Physics and Recitation II (GS1102) and General Physics and Recitation II - Honors (GS1104). The course comprises primarily of experiments related to electromagnetism (experiments on electrical and magnetic properties and experiments related to electronic engineering) and experiments on optics, and data analysis and interpretation of experiment results are particularly emphasized.

GS1201 General Chemistry and Recitation I [3:1:3]
This course deals with the basic principles and concepts needed to chemically understand the phenomena taking place around us at the molecular level. The course introduces chemical formulas, chemical reaction formulas, atomic and molecular structures and bond theories viewed from the perspective of classical mechanics and quantum mechanics, chemical bond, transition metal chemistry, properties in the gas phase and condensed phase, etc.

GS1202 General Chemistry and Recitation Ⅱ [3:1:3]
In this course, thermodynamics, chemical equilibrium and reaction kinetics are learned systematically based on the basic concepts dealt with in General Chemistry I. Detailed subfields of chemistry are introduced including electrochemistry, spectroscopy, materials chemistry, polymer chemistry and biochemistry.

GS1203 General Chemistry and Recitation I - Honors [3:1:3]
Core details of chemistry including atomic theory, the origin of atoms, atomic structure, chemical bond, molecular structure and molecular interaction are composed in a single story centered on Haber's ammonia synthesis, DNA double helix, etc. Also, classes are conducted in presentations and discussions by reading Nobel prize-winning lectures of Perrin (Avogadro constant), Penzias (*The origin of the Elements*), Curie (radioactive atoms), Rutherford (nuclear structure), Pauling (chemical bond), Debye (molecular structure) and van der Waals (gases) as well as major papers of Lewis (octet rule) and Miller (chemical evolution).

GS1204 General Chemistry and Recitation Ⅱ - Honors [3:1:3]
In continuation of General Chemistry and Recitation 1 – Honors, this course completes the story that starts in the 1st semester primarily on Nobel prize-winning lectures of Penn (chemical thermodynamics), Haber (chemical equilibrium), Herschbach (chemical reaction rate), Ertl (catalysis), Arrhenius (acid and base), Watson-Crick (DNA) and Calvin (photosynthesis). For instance, classes are conducted in presentations and discussions of the principles of chemical equilibrium and reaction rate in regards to Haber's ammonia synthesis, acidic and basic characteristics of amino acids, proteins and DNA, and the principle of oxidation and reduction contained in photosynthesis.

GS1211 General Chemistry Experiment Ⅰ [0:2:1]
Chemistry is the area of study centered on experiments. This course introduces the basic concepts of chemistry in addition to quantitative analyses and data processing, which form the foundation of chemistry experiments. By performing experiments in understanding of molecular structure through molecular modeling, extraction using the polarity of molecules, organic reaction, chromatography (TLC, HPLC) and spectroscopy (UV-vis, FT-IR), the basics of chemistry experiments and the latest analytical devices are studied.

GS1212 General Chemistry Experiment Ⅱ [0:2:1]
Based on the basics of chemistry experiments learned in General Chemistry Experiment I, this course conducts basic experiments in each of the areas of thermodynamics, analytical chemistry, biochemistry, electrochemistry and synthetic chemistry. The fundamentals and applications of chemistry are to be studied by dealing with spectroscopy, analytical devices for chromatography, understanding of protein and nucleic acid structures through molecular modeling, acid-base titration, chemical cells and solar cells. Through this course, students acquire the basics needed for experiments in chemistry and other related majors.

GS1301 Biology [3:0:3]
This course introduces the principles and fundamental concepts of Biology. The course is designed to emphasize on selected topics from Cell Biology and Molecular Biology. The topics for the first half will include: Biological Molecules, Polymers, Cell Organization and Membranes, Enzymes and Energetics, Mitochondria and Cellular Respiration, and Photosynthesis. The second half of the course will cover topics such as DNA, RNA and Proteins, Genome and Chromatin, Gene Regulation, and Recombinant DNA Technology.

GS1302 Human Biology [3:0:3]
Human biology has two primary functions to understand how the human body works; and, to understand the relationship of humans to other living things in the biosphere.

GS1303 General Biology – Honors [3:0:3]
This course is designed for students who will either choose biology-related fields as a major or a minor or wish to examine the field of Life Sciences with a convergent mind. Fundamental topics dealt with in biology are similar but it aims to provide education tailored to students through a more involved learning method. The course has been designed to help students before entering detailed majors to understand the principles and essential functions of life phenomena through case studies of the latest research and a comprehensive, in-depth examination of various topics selected from subjects including cell biology, biochemistry, genetics and molecular biology. As the following course, Exploring Life Sciences through Experimentation (GS2311) is recommended.

GS1311 General Biology Laboratory [0:2:1]
General Biology Laboratory (GS1311) is a required experiment course in biology that must be accompanied with Biology (GS1301), Human Biology (GS1302) or General Biology – Honors (GS1303), and aims to acquire the fundamental methods of biology experiments and the basic techniques used as a standard at all Life Sciences laboratories. Upon successful completion of this course, students will have been cultivated with basic capabilities to start their independent research in the future and, at the same time, built a foundation to perform experiments with a high degree of difficulty.

GS1401 Computer Programming [3:1:3]
The Computer Programming course aims for students in a college curriculum to obtain basic knowledge in computer programs and gain problem-solving ability with such knowledge. As a means to accomplish this, basic grammar for the C programming language is introduced, and intensive contents such as arrays, pointers, structures, etc. are learned. Moreover, through programming using the C programming language during exercise periods, the ability to solve real problems is also to be cultivated.

GS1402 Introduction to Electrical Engineering and Computer Science [3:0:3]
Mankind lives in an era of information and communications revolution also known as the Internet and cyber society. Such changes in life have taken place based on Electrical Engineering and Computer Science. This course deals with the introduction to Electrical Engineering and Computer Science centered on the basic principles of Electrical Engineering and Computer Science, the history and direction of the growth of IT engineering as well as its challenging assignments of the future.

GS1431 Modern Mechanical Engineering [2:0:2]
This course introduces new themes in advanced mechanical engineering including devices often encountered in modern civilization such as advanced vehicles, aircraft, robots, home appliances and medical devices as well as major technologies of mechanical engineering including advanced manufacturing and automated production machines, ultra-precision machines and other enhanced industrial machines that are being broadly applied, in addition to future nanotechnology, space technology and energy technology.

GS1471 Field Study for Earth and Environmental Research [0:4:2]
Aiming at expanding the knowledge and understanding of the latest topics in the environmental research field, this course comprises 4-hours-per-week field training by visiting our Graduate School of Earth Sciences and Environmental Engineering, companies and national and public environment research institutes (National Institute of Environmental Research, Korea Meteorological Administration, etc.) to listen to the lectures of experts in environmental research and tour their research facilities.

GS1490 Software Basics and Coding [1:2:2]
This course deals with the fundamental knowledge of software programs such as the C programming language and Python, and teaches the basic coding techniques of the aforementioned programming languages. Furthermore, the course aims to cultivate the ability to solve various real-world problems by utilizing such software coding techniques.

GS1491 Software Practical Use and Coding [1:2:2]
From the emergence of Big Data, Machine Learning and Deep Learning technologies have evolved and, as the Frameworks and Libraries that developers can actually realize have materialized, the establishment of AI Services is becoming commonplace. Based on Python, the standard language in the area of Machine Learning, the use of TensorFlow, Regression, Classification, Convolutional Neural Networks (CNN), Recurrent Neural Networks (RNN), Long Short-Term Memory models (LSTM) and Generative Adversarial Networks (GAN) are practiced to learn the basics of Deep Learning and understand AI.

GS1511 Writing I: Logical Writing [3:0:3]
This course aims to cultivate the ability of logical communication for students. Under the premise that the process of logical writing is a social interaction, students sequentially learn and discuss the steps of logical writing in collaboration. Therefore, the learning of this course focuses not on the “acquisition of knowledge” but, rather, on the learning of the “problem-solving process” through writing.

GS1512 Writing I: Academic Writing [3:0:3]
This course not only helps students to equip themselves with comprehensive proficiency in the Korean language and carry the life of language as cultured individuals but also helps students learn the basic theories of academic writing needed during university life and foster skills, demanded by the university, to read and analyze academic writing through actual writing exercises. Secondly, the course enables to nurture their ability to write accurately through writing exercises, correction and face-to-face guidance by professors. Thirdly, the ability to present and discuss is developed in the process of preparing and completing a report.

GS1513 Writing I: Creative Writing [3:0:3]
In this course, the concept and meaning of creativity in writing as well as the fundamental elements that constitute creativity are learned and, by utilizing such knowledge into writing exercises of various contents and formats, creative writing is to be instilled into the minds of students. Through this course, students will be able to cultivate communication skills and enhance their ability to think and express creatively.

GS1531 Writing II: Writing about Science [3:0:3]
This course aims to have students learn and practice writing to deliver knowledge in the field of science and technology to common readers in an easy to follow, articulate manner. In this class, students will explain scientific theories by using only the minimum number of simple tools, write science stories for children and, at the end of the semester, write and discuss scientific essays.

GS1532 Writing II: Reading the Classics & Writing [3:0:3]
This course aims to conduct deep reading and discussions on Korean classical texts and, based on this, have students understand various thoughts and methods of ancestral writing. Through this, the course also views the issues we face today in a critical and creative manner, and attempts various forms of writing as a means to prepare ideas for solutions.

GS1533 Writing II: Critical Writing [3:0:3]
As long as humans think and cognize, a critique is a natural behavior. Critical writing is a work that discovers questions from various by-products and phenomena of the world and rearrange them in a new context. In this course, students produce problems on their own and access diverse discussions through theoretical investigation. Furthermore, they share the outcomes with others through the medium of writing and, thus, grow as members of an analytical community equipped with a critically discerning eye.

GS1601 English Ⅰ: Study Skills for Freshhumans [3:0:2]
English I: Study Skills for Freshhumans is an English-only integrated-skills course, designed to help GIST freshhumans to improve their general communicative skills and particularly to develop study skills needed in the English-medium college classroom, such as listening, note-taking, presenting, and paragraph writing.

GS1603 English Ⅰ: Presentation and Discussion [3:0:2]
English I: Presentation and Discussion is the alternative to English I: Study Skills for Freshhumans for qualifying students. Students will learn the essential skills of presenting and debating in English, on both technical and non-technical topics relevant to GIST freshmen.

GS1605 Practical Discourse [3:0:2]
This course provides the foundations for verbal communication in order to effectively maneuver within an English academic and professional environment. Key components of discourse such as asking questions, expressing opinions, compromising, contradicting, and generally navigating through English conversation will be introduced and further developed.

GS2001 Multivariable Calculus & Applications [3:1:3]
The course deals with calculus of multivariable functions and vector functions as well as their basic concepts and applications. The course is based on a vector function's continuity, differentiability, directional differentiation and geometric structural analysis, and aims to have students understand theories on multiple integrals, line integrals and surface integrals. Through this course, students are able to establish abstract concepts and learn basic proofs with increased mathematical strictness.

GS2002 Differential Equations & Applications [3:1:3]
This course studies the establishment and solutions of differential equations, an essential element of mathematics and engineering, as well as their applications to natural sciences and engineering. Students learn about the existence and uniqueness of the solutions of ordinary differential equations, linear differential equations, systems of linear differential equations, Laplace transform, Fourier series, overview and numerical solutions of partial differential equations, etc.

GS2004 Introduction to Linear Algebra & Applications [3:1:3]
Linear algebra is a fundamental prerequisite course in mathematics and a required subject for science and engineering majors along with calculus. In this course, students gain in-depth understanding of vector spaces, which is a basic concept of algebra, and linear deformation among these as well as the theory on matrices expressing vector spaces. In addition to geometry and differential equations, students also study applications and utilization in signal processing, control theory and other aspects of engineering majors.

GS2006 Foundations of Mathematical Thinking [3:0:3]
This course can be utilized as a prerequisite for students who have completed all courses required for general mathematics and wish to go on to take upper-level courses (electives) in mathematics or subjects in need of induction and abstraction. By examining the concepts that form the most basic foundation for various fields of mathematics and the process of strict proofs, mathematical thinking is developed and the method of abstraction is learned. The course introduces the exact meanings of axioms, definitions, theorems and proofs, and the methods of proof and induction, and trains students to apply them.

GS2007 Introduction to Mathematical Thinking [3:0:3]
In this course, how to think mathematically is developed and how to precisely prove oneslef in the axiomatic system is trained. To foster the ability of reasoning, students must be able to interpret mathematical texts precisely and express their own thoughts accurately with a language. In addition, text reading, discussion and mathematical writing (proof) as well as the basic methods needed for mathematical thinking are learned. (This course is based on the number system, functions and induction, and deals with the basics of the number theory, counting, continuity of real numbers, the concept of infinity, continuity of functions and the system of complex numbers.)
Also, examples in which mathematical thinking is utilized in daily life or various fields of other studies are discovered and analyzed, and students develop the ability to think and differentiate examples in which it is properly utilized from those that are incorrectly used.

GS2104 History and Philosophy of Physics [3:0:3]
The objective of this course is to introduce the major theories of physics in a historical context and to promote understanding of relevant philosophical issues. First, the course discusses historical development process of classical physics such as mechanics, electromagnetism and statistical mechanics and also the deterministic worldview based on the historical development. Then, the course focuses on the beginning and growth of modern physics including the theory of relativity and quantum physics as well as their philosophical implications and deals with related worldviews. Finally, the course aims to have students understand the relevance between physics and other fields of science, and views physics in the perspective of big history.

GS2202 Physical Chemistry Ⅰ [3:0:3]
Physical Chemistry I deals with thermodynamics and basic statistical mechanics needed to express physical changes and chemical reactions of materials from the standpoint of the macroscopic world. Students learn about the laws of thermodynamics and the concepts of free energy, and utilize these to understand various physical and chemical phenomena such as phase equilibrium, chemical reaction and ideal solution. Also, the fundamental concepts of statistical mechanics needed to understand chemical equilibrium at the molecular level are introduced as well. The major topics to be dealt with are equilibrium, reversibility, ideal gas and non-ideal gas, energy, entropy, free energy, phase variation, chemical reaction equilibrium and ideal solution.

GS2204 Current Topics in Chemistry [1:0:1]
For students who are interested in chemistry research and have taken basic chemistry courses, this course selects research topics in chemistry of which domestic and international researchers are actively performing research on, and introduces them to students and, going beyond the stereotypical flow of classes centered on textbooks, enables students to acquire methods of experiments, analyses, etc. based on research topics.

GS2206 Directed Group Study in Chemistry [1:3:2]
This course is for sophomores and juniors who are interested in chemistry research and have taken basic chemistry courses. The course allows 2 to 3 students to form a small group to implement on their own a series of process from literature investigation, preparation and execution of experiments to data analysis, presentation of results and preparation of reports in order to solve a problem presented from one of the fields of synthetic chemistry, physical chemistry and biochemistry.

GS2303 Current Topics in Modern Life Sciences [1:0:1]
This course is for freshhumans and sophomores who are interested in Life Sciences and for students from other majors. The course introduces research projects that are gaining a lot of attention in the field of Life Sciences in an easy-to-understand seminar format and not only grasps the trends in the modern Life Sciences but also helps students to understand the expandability of Life Sciences and the connection to other fields.

GS2311 Exploring Life Sciences through Experimentation [3:1:3]
Exploring Life Sciences through Experimentation is an elective designed for students who will choose their majors or minors in the field of Life Sciences in the future or who wish to deal with the field of Life Sciences with convergent thinking. This course requires students to have completed Biology (GS1301) or General Biology – Honors (GS1303) and General Biology Laboratory (GS1311) as prerequisites. Exploring Life Sciences through Experimentation aims for students to acquire the intensive principles and methods of biology experiments through individual exercises and simultaneously learn how to design and execute experiments that suit the objectives on their own as independent researchers. Upon successfully completing this course, students will have developed the ability to conduct their own independent research in the future and also establish hypotheses to design and implement experiments on their own. The follow-up course, Gene Expression and Analysis (GS3311) is recommended.

GS2407 Structure and Interpretation of Computer Programs [3:0:3]
This course is an introduction to the abstraction techniques of programming and enables a programmer to think in the abstraction stage of a suitable level, not the level of hardware. The course avoids studying individual features of programming languages and, rather, pursues to have students learn general programming techniques such as object-oriented programming or functional programming.

GS2408 Object-Oriented Programming [3:0:3]
This is a course on Java language with a focus on learning the object-oriented programming. This course includes basic concepts of object-oriented programming, which are class, encapsulation, polymorphism and inheritance as well as the fundamental techniques of GUI and concurrent programs. Java is the most popularly used language in mobile applications.

GS2451 Materials and Future Science and Technology [1:0:1]
Materials Science and Engineering is arguably the study that leads future science and technology among various fields of study. This is because innovation of technology without the support of new materials is nearly impossible. This course deals with the subject of Materials Science and Engineering as well as the trends in advanced new materials and recent related research. The faculty of the School of Materials Science and Engineering equipped with professional research capabilities in the school's primary research areas, which include optical and semiconductor materials, nanoelectronic materials, organic materials for information processing, energy materials and biomedical materials, provide introductory-level lectures that lower-grade undergraduate students are able to understand.

GS2471 Earth and Environmental Science [3:0:3]
Earth and Environmental Science is based on general sciences in physics, chemistry, biology and earth sciences specialized for the understanding of environmental phenomena, and emphasizes professional education, which encompasses engineering mathematics, mechanics, organic and inorganic chemistry, electrochemistry and microbiology, that enable to interpret the phenomena on various environmental media. The course conducts education that helps possess the knowledge and experience in climate change response, prevention of environmental pollution, etc. for the realization of a sustainable society.

GS2472 Climate Change: Action and Adaptation [3:0:3]
Ever since the Paris agreement in 2015, every country around the world has started to deal with the current climate change vigorously in order to comply with the Paris agreement and to regulate environmental impact that are about to return to themselves. However, most Koreans still do not understand the impact the new climate regime will have on them, or how to prepare for climate change in the future. In this context, to stimulate students, this course covers subjects such as the definition of climate change to promising Fourth Industrial Revolution technologies which will be useful in the new climate regime. The current course will provide students with the opportunity to contemplate our future.

GS2473 Introduction to Earth Science and Environmental Engineering [1:0:1]
This course introduces various research topics in the field of Earth Science, which encompasses atmospheric science, oceanography and ecology, and of Environmental Engineering related to water treatment and energy. The course aims to stimulate interest in the field of Earth Science and Environmental Engineering and stress the importance and the need of environmentology.

GS2501 Korean Narratives and Our Life [3:0:3]
The concept of story was born the day humans first began to live on this earth. Stories traveled from the mouth of one person to the next before spreading broadly among many people and, in the midst of the flow of time, they have constantly changed the accounts like a living creature. Of course, new stories continue to be created as we speak. The stories that have been handed down to this day formed classical narratives.
This course aims to not only read, enjoy and critique major works of narratives within our classics but also critically and creatively reflect on various issues that we are facing today. To achieve this, we must begin from today's perspectives, or our critical minds. We will find ways to solve problems as we deeply think about what kinds of questions our narratives and, furthermore, humanities, will pose regarding the problems "here and now" and, based on this, which new questions we are going to have to pose. Also, connecting such thoughts and means to the solutions with the production of new "contents" is one of the primary objectives of this course.

GS2503 Understanding Modern Korean Fiction [3:0:3]
This course aims for students to expand their aesthetic and ethical prospects through modern Korean fiction. Through the understanding of Korean fictional texts from the same era, our own lives reflectively reasoned and a new perspective on the community we belong to is sought. In addition to this, the path to become an active and proactive reader is searched by enjoying and analyzing modern Korean fiction.

GS2505 Understanding Classical Korean Poetry [3:0:3]
A poem condensed with ideas in a musical rhythm essentially sprouts on the margin amidst the condensation. A margin is undoubtedly the source of new imagination. In classical Korean poetry, we encounter the sensibility, critical minds, introspection and literary imagination of our ancestors towards people and life. A sweet scent from classical Korean poetry will stimulate our barren emotions and enable us to reflect on our lives, thus greatly contributing to our inner self to be more abundant and substantial. This course aims for students to not only critically enjoy the major works of classical Korean poetry but also understanding them by relating to our lives today.

GS2506 Modern Korean Poets [3:0:3]
This course deals with poets who were important in modern Korean poetry up to the 1950s including Han Yong-un, Kim So-wol, Jeong Ji-yong, Baek Seok, Seo Jeong-ju and Yun Dong-ju. Students will investigate and research each of the poets and thoroughly read and discuss their poetry. Also, for a complete understanding of each poet's world of poetry, students will write poems inspired by the works of the poets.

GS2507 Understanding Poetry [3:0:3]
Through this course, students will understand the general theory of poems and read various poetry from all ages and countries. By doing so, students will be able to think on their own what poetry is and change their lives in a poetic way.

GS2509 Modern Korean Fiction and Social Reflection [3:0:3]
This course aims for introspection of in-depth various social symptoms depicted in modern Korean fiction. Until now, Korean fiction has recorded expectations, forecast, contradiction and paradox contained in the changes of Korean society with its unique imagination and discernment. Starting from the early modern period during which railroads were introduced for the first time all the way to Gwangju and Sewol Ferry, students will explore the questions raised by the literature on modern-day Korea.

GS2510 Korean Classical Literature and Thoughts [3:0:3]
This course aims for students to enjoy classical Korean texts and understand their ideological contexts and, through this, aspects that relate literature and ideas are understood. Moreover, such understanding on literary ideology is to be applied to our critical and creative views on problems of today.

GS2511 Reading Contemporary Poetry [3:0:3]
Students will read various works and discuss the structure and language of poetry. In doing so, they will learn and understand various poetic languages and, through this, ultimately comprehend how poetic reasoning develops.

GS2512 Wohumans in Korean Fictions [3:0:3]
"Women," as imagined and reproduced by Korean fictional works since the 20th century, have raised issues with old customs and conventions and expanded the prospect of Korean literature. This course especially reviews the new topics, sentiments, formats, etc. of literature that have been discovered and pioneered by Korean female fictional works from the colonization period to the present in the sociocultural context of the day. In addition to various domains of intimacy and sexuality such as marriage, family, dating and love, students will also explore how Korean fictional works have been discovering the "ssues of women" ver the course of enormous changes such as modernization, democratization and globalization.

GS2521 Heroes and Antiheroes: Understanding Modern Western Literature I [3:0:3]
This course contemplates the characteristics of modern Western literature primarily centered on the concept of "heroes" and "antiheroes." Unlike traditional heroes from ancient epic poetry, tragedy or medieval chivalric romance, the "heroes" in modern Western literature exist within the inevitable conflicts among tradition, hierarchical order and social values, and are protagonists who approach the boundary with "antiheroes." This course will first examine the characteristics of modern Western literature through the reproduction format of *Don Quixote*, the most unique and interesting (anti)hero in modern Western literature, and then analyze the deformations of various heroes and antiheroes that appear in 『*The Lord of the Rings*』, written based on the vast knowledge of Author Tolkien in the myths, legends and literature of different European countries.

GS2522 Individuality and Identity: Understanding Literature of Growing Up [3:0:3]
This course helps in the understanding of bildungsroman, one of the main genres of modern Western literature, and enable students, currently in the transitional period from adolescence into adulthood, to share active interpretations and discussions about the characters from bildungsromans who try to find their identities while being conflicted between the demands from society (including family and school) and their own individuality.

GS2523 Reading English and American Short Stories [3:0:3]
This course primarily aims to have students thoroughly read English and American short story masterpieces to raise their level of interest in and the ability to enjoy English literature and literature in general. Students will read each of the short novels centered on the "story," the most fundamental appeal of literature to general readers, not professional researchers in (English) literature, while simultaneously training to read and analyze various core topics that lead the "story," from growth and love and problems between humans and wohumans to civilization and barbarism and the issue of neglect and ego. Considering the length, level, etc. of the novels, English texts and translated versions will be read together.

GS2524 Understanding Comedy and Humor [3:0:3]
"Laughter" is the indicator of flexible, clever and creative mental activities for both the person who laughs and the one who makes others laugh (except for slapstick) and requires a high level of linguistic sensitivity. To understand the fundamental meaning and power of "laughter," this course aims to carefully select and read various lower-level genres of comedy and short story novels primarily in English literature. By reading Shakespeare's romantic comedies, the most representative kind of comedy (in English literature), as well as farce, comedy of manners and the theater of the absurd, the course will review a variety of rhetorical and situational techniques that arouse laughter including puns, wit, irony, burlesque and cross-dressing. Also, students will conduct philosophical discussions on multilayered roles of comedy and laughter, which not only provide temporary excitement but also enable flexible and liberated thinking and, moreover, turn power relations in reality upside down for satire and festive subversion.

GS2525 Adventures of Modernity: Understanding Modern Western Literature Ⅱ [3:0:3]
"Adventure" is a symbol of contemporary planning as well as a physical, economic reason that enabled the modernization of the Western world after the Age of Exploration. This course aims to deepen the understanding of modern Western (literature) by having students read together the modern "writing-back" works or critical responses on major works of "adventure" literature, an important genre in modern Western literature.

GS2526 Lovers in Literature [3:0:3]
Through the works of various genres dealing with "love," a topic that cannot be left out of literature, this course goes beyond the simple discussions on dating but, rather, aims for each individual to explore love as romantic and liberating desire, or the source that enables us to dream of and achieve overcoming of not only social constraints and suppression but also the incomplete self of the present.

GS2541 Understanding Western Music [3:0:3]
This course aims to have students understand the basic compositions and expressions of Western music along with the social background in a comprehensively artistic manner. While learning how music has been expressed together with the social and cultural background of each era through the flow of history, students will listen to major works of renowned composers to approach music in a cultural and artistic fashion. Also, the course analyzes the effect on contemporary music and examines in what forms it is being expressed in the present age that we live in.

GS2542 Opera and Pansori [3:0:3]
This course aims to comprehensively understand the fundamental theories, composition, instruments and music history of Western music and Korean traditional music. In particular, the course compares musical plays of opera in the Western world and pansori in Korea by analyzing their origins, development processes, characteristics and generational backgrounds in the sociocultural flow. Through the exploration of and listening to major pieces, the course also compares Western music and Korean traditional music to discover their similarities and differences while cultivating a broad understanding and fundamental grounding of music.

GS2543 Understanding Modern Art [3:0:3]
Since the mid-19th century, art has been functioning as a counter-discourse in a capitalistic society governed by instrumental rationality through the critical sense of identity and aesthetic sensibility of artists as well as the radicalness of critical discussions about the works. This course aims to have students understand the trends and characteristics of complex art, which is differentiated by terms such as modernism, postmodernism and pluralistic culture, and imagine an alternative world based on sensitivity.

GS2601 Tradition and Modern Transformation in East Asia [3:0:3]
Today, the East Asian region (centered on Korea, China and Japan) is becoming one of the main axes that moves the world politically, economically and culturally, which has led to active discussions on the formation of an "East Asia community." This course will first examine whether or not East Asia as a whole geographically and culturally possesses common characteristics insomuch to form a community. The course will then historically investigate what kind of a change process that this region, which had yielded to or been intimidated by Western forces since the opening of modern ports, has experienced to have grown into a force that moves the world today. The course enables students who seek to major in natural sciences to understand the history and culture of East Asia and become global East Asians who will have grasped the identity of the region.

GS2602 Understanding Korean History [3:0:3]
Accurate understanding of Korean history is mandatory for GIST students. However, the previous enumerative, nationalistic Korean history education is to be avoided and, instead, a new approach and method of recognition of Korean history are proposed and understood. In particular, this course historically highlights the position of Korea in the midst of international relations and the life and culture of ordinary citizens that have been overlooked for students to expand their perspectives.

GS2603 Modernization in East Asian Countries [3:0:3]
The course compares and reviews the modernization processes of Korea, China and Japan after the mid-19th century. The differences in the forms of response to the West are found in the characteristics of traditional cultures and different demands in the opening of ports by Western powerhouses, and the process of efforts, frustrations and today's accomplishments in regards to the enlightenment by each of the countries is historically reviewed.

GS2604 Understanding China Today: Enlightenment, Revolution, and Market [3:0:3]
The 21st century is referred to as China's century. China, which had lost its authority in global politics after the 19th century by the expanded Western power, has been rapidly restoring its influence since the late 20th century. This course reviews China's failures and efforts for modernization after the 20th century as well as the socialism experiment and the process of modernization, and also enables to acquire a perspective on the forecast of China, the powerhouse of the 21st century.

GS2611 History of International Relations [3:0:3]
This course studies the historical flow in international relations after modernization and aims to prepare a foundation for the understanding of various issues of global politics that the world and Korea face in the 21st century. In particular, the major contents of this course begin with the Westphalian system after the Thirty Years' War in the 17th century and include changes in international relations of the establishment of international relations in the 18th century, the Great Powers' politics and imperialism in the 19th century and the ideology competition and the end of the Cold War in the 20th century.

GS2612 Classical and Medieval Civilizations in the West [3:0:3]
This course aims for students to contemplate on major issues in classical and medieval Western societies and understand their impact on the formation of Western civilizations. The major contents of the course are divided into classical West and medieval West. By the midterm exams, the course will have explained the growth of major city-states (Athens and Sparta) in ancient Greece, the formation process of political systems (democracy, oligarchy), the Roman Republic and the Mediterranean world during the Roman Imperialism period. After the midterm, the course will explain what the transition from classical to medieval really is and summarize the concepts of the medieval West and the medieval history of the West as a whole.

GS2613 Contemporary Western History [3:0:3]
This course aims to examine the development of 20th century contemporary Western history and subsequently cultivate a balanced historical awareness and a critical perspective on the generational reality that we live in today. The early part of the course will primarily deal with how the 19th century Western system, which had been created within the context of modernization, capitalization and industrialization, changed together with World War I. The course's essential topics will include the Russian Revolution, the Great Depression and the resulting collapse of 19th century liberalism. The latter part of the course will study the post-war systems formed after World War II and subsequent changes as well as cultural and social fluctuations that appeared from such systems. The topics that will be at the center of the latter part of the course include the Cold War, the growth of the 3rd world, the rise of pop culture and the Americanization process, globalized economic order, the end of the Cold War and the fall of socialism.

GS2614 Early Modern Western History [3:0:3]
This course aims to introduce the history of the West, Europe and the Americas to be more specific, from the 16th to 18th century. The course will first survey the dismantling of medieval society and then go over the pioneering of new sea routes, the formation of the global system, the Reformation and the division of Europe, the appearance of absolutistic nations and the Enlightenment, the scientific revolution and other major historical events and intellectual achievements that helped form "modernity" in the early modern period.

GS2615 Socialism: Theories and History [3:0:3]
This course aims to historically approach various socialistic movements and experiments that appeared as an alternative to capitalistic society. Looking at the history of mankind, thoughts and movements on diverse utopias appear. In particular, such utopia movements prior to the modern period retain a strong religious tone. The primary axis of social movements after the modern era continue the footprints of such utopia movements but also shows a clear difference, which is because it is closely related to the capitalistic system. This modern and contemporary socialist movement, which can also be said to be the secularization of utopianism, can, therefore, be analyzed only in relation with modern capitalism. Along such a critical mind, this course will first analyze modern capitalism and review the development process of socialism ideology and movement, notably Marxism and the development of a movement according to this ideology, and then approach the attempts and failures of the first nations with successful real socialism.

GS2616 The West in the "Long" Nineteenth Century [3:0:3]
This course aims to explore the 19th-century history of the West that opened the age of industrial capitalism and liberalism. This is the era during which the fundamental form of modern capitalism was completed, and features a chronicle that starts from the French Revolution and the U.K.'s Industrial Revolution, goes through the age of imperialism, and ends with World War I. Fundamentally, this is the era in which the general characteristics of modernity, centered on progress (evolution) and growth, began to spread throughout the world and also when the basic contradictions of capitalism took shape and alternative thoughts subsequently outburst. This course will examine the overall structure and contradictions of the West in the long 19th century as well as the movements to overcome them.

GS2618 History of East Central Europe and Russia [3:0:3]
This course deals with the history of East Central Europe and Russia, which occupies another axis of European history. Despite being an extremely important region in the changes of European and World history ever since the medieval period, the area has not gained much spotlight. Therefore, this course will generally deal with the geographical coverage of the region as well as its economy, society and culture as a whole for a comprehensive understanding of the region's history.

GS2620 Basic Problems of Philosophy [3:0:3]
What is philosophy, or what does it mean to practice philosophy? This course aims to introduce to and train students who first encounter the subject of philosophy on what it is to practice philosophy or what it is to think philosophically. For this, students will critically examine and discuss what kinds of important philosophical issues have been traditionally raised and how philosophers have actually dealt with these issues through this course.

GS2621 Philosophy, East and West: Buddhism and Christianity [3:0:3]
This course will examine the ideas of Socrates the "philosopher' who is the main source of Western thought; Confucius, the source of East Asian thought; Buddha, the founder of Buddhism; and Jesus, the founder of Christianity, and also think about their influence on the history of mankind. The work to understand the period during which the intellectual history of mankind was formed, which is popularly known as the Axial Age, is absolutely necessary for the diversity of contemporary culture, communication and conversations among civilizations. Going beyond the theological, doctrinal and religious perspectives, students will strive to understand the ideas of each person as a teacher of the human spirit and the main source of a thought.

GS2622 Understanding World Religions [3:0:3]
The course aims to have students study various "worldviews" that form the modern world and secure a perspective of comprehensively grasping the diversity and unity of human cultures. The course aids in the understanding of how to analyze world views as well as their roots and history, and examines as a whole the development of mankind's civilization history, which includes the history of philosophy, religion, ideas and arts, from the standpoint of global history.

GS2623 Inquiry into the Unconscious: Freud, Jung, and After [3:0:3]
Since Freud's discovery of the unconsciousness, the perspective on humans has fundamentally changed. Psychoanalysis founded by Freud shows the possibility of understanding mankind's mental world in a deeper manner. This course aims for students to examine the history of exploring the unconsciousness and understand the important flow of modern thought that explains about humans and society from the perspective of unconsciousness.

GS2625 Introduction to Oriental Philosophy 1 [3:0:3]
This course aims for students to read and understand the two main schools that form Orientalism: "Confucianism – Analects/Mengzi" and "Taoism – Lao-zi/Zhuangzi." The thoughts of these two schools represent humans' universal thinking activities of "order" and "freedom" that may seem contradictory. Through this course, students will be able to get a sufficient taste and experience of the depth and charm of Orientalism.

GS2626 Understanding Korean Philosophical Tradition [3:0:3]
Korean philosophy during the Joseon Dynasty is represented by Seongnihak, Neo-Confucianism, and Silhak. This course focuses its exploration on Toegye, Yulgok and Dasan who represent these two thoughts and also offers the opportunity for students to understand their marvelous achievements in the intellectual history of Korea. Also, because understanding of Korean philosophical tradition should be done within the ideological context of East Asia, students will naturally have a chance to study the ideological tradition of China since the modern times.

GS2627 Messages from Myths and Symbols [3:0:3]
As an emotional and physical being, a human thinks in symbols. Although thinking in symbols may seem illogical and contradicting, mankind will become dry beings like robots without them. A symbol is not an auxiliary tool that assists logical language but rather a condition that constitutes a person. In that sense, a human is Homo Symbolicus. Myths, which are important cultural heritages of mankind, are symbols themselves. By cultivating the ability to understand symbols, students will be able to train how to decipher the messages and cultures hidden in all stories.

GS2628 Reading Western Philosophy Classics [3:0:3]
The Frankfurt School succeeded the thoughts of Nietzsche, Freud and Marx, and expanded and developed their thinking into the topic of understanding of modern society and contemporary rational criticism. In this course, students will read the philosophy classics of major thinkers of the Frankfurt School to understand the meaning of modernity formed in the West and to think about the methods and principles of modernity and rational criticism.

GS2629 Sun Tzu's *Art of War* and Art of Living [3:0:3]
For all ages and countries, the *Art of War* is regarded as one of the most important war theories and philosophies. However, the *Art of War* does not stop at being military literature that simply talks about war strategies and methods but, rather, is a book on the philosophy of life, which contains profound views on life. Sun Tzu's *Art of War* has a broad influence as a classic that prompts thinking in the areas of management, politics, economy and life. Through the *Art of War*, this course aims to understand an aspect of Orientalism and simultaneously focuses on war strategies as a philosophy of life.

GS2630 Political Philosophy of *Han Feizi* and Legalism [3:0:3]
<*Han Feizi*> is an important writing written by Han Fei, a philosopher from the latter days of the age of civil wars (B.440~B.221), and compiles thoughts and ideas of law. The essence of *Han Feizi* is the political philosophy and governance by emperors. <*Han Feizi*> is not a simple theoretical writing but, rather, a repository of thoughts and wisdom that stimulate imagination on the element of governance through a variety of tales. This course offers students the opportunity to think about the power of story and the meaning of leadership.

GS2651 Debate and Argumentation for Scientists [3:0:2]
In this course, you will learn the fundamentals of inter-collegiate debate, including structure, note-taking, basic argumentation, strategies, fallacies and public speaking. Students will participate in several practice debates throughout the semester, as well as mini debates and argumentation/critical thinking activities. Additionally, students will practice refuting junk science and pseudo-science assertions. Students will have the option of participating in weekend tournaments with other universities during the semester.

GS2652 English Ⅱ: Introduction to Academic Writing in Science and Engineering [3:0:2]
English II: Introduction to Academic Writing in Science and Engineering is a required course for GIST students in the second year. Students will learn the essential skills of academic writing in science and engineering, including the basics of research writing.

GS2653 Research Ethics: R&D (Reading & Discussion) [3:0:2]
This course will provide a foundation to help students understand the various ethical issues affecting scientific research by: 1). surveying the historical origins of modern research ethics, 2). examining current issues and trends related to research ethics, and 3). reviewing case-studies of research misconduct.

GS2654 Creative Expression in English [3:0:2]
This course is meant for students who wish to have additional English writing practice. In this class, students will express themselves through writing, learn about and practice a variety of creative writing techniques, as well as review fundamental grammar skills. This is an opportunity to build up writing skills and learn the nuances of grammar in a much more informal and fun setting.

GS2655 Journalism and News Reporting in the Digital Age [3:0:2]
Journalism and News Reporting in the Digital Age is designed to help students share their scientific expertise and opinions by developing their journalistic skills in writing various news stories, including science-related news stories, for online digital media. Please note that students will be required to create a social media presence on the Internet for this course.

GS2661 Logic and Critical Thinking [3:0:3]
Through this course, students will understand the major concepts and principles of logic and apply such logic to evaluate ordinary arguments to cultivate their ability to think analytically and critically. Students will learn basic-level deductive logic and inductive logic and, at the same time, also be trained on how such principles of logic can be applied to actual life and exploratory situations in various academic fields.

GS2701 Understanding Korean Society [3:0:3]
This course aims for students to learn how to analytically apply the concepts and theories of social sciences in understanding Korean society. Through an examination of socialization, daily life and culture, family, class and inequality, sexuality and gender, religion, media, companies and labor, education, crime, politics and cities, environment and globalization, the course wishes to review by which means these topics are realized in Korean society not only historically and analytically but also from the standpoint of everyday life, structure and behaviors, and systems.

GS2702 Understanding American Society [3:0:3]
This course aims for students to understand American society in a historical and analytical manner. For this, students will apply various socioscientific theories and concepts to comprehend American society. The course will also examine the relationships among the U.S., Korea and the world to deepen their understanding of American society.

GS2703 Globalization and Development: Mapping Politics, Economy, and Culture [3:0:3]
The world we live in is mutually connected worldwide, and events happening on the opposite side of the globe often have a direct impact on our daily lives. If we call such a situation globalization, this course primarily examines the relationship between globalization and the living conditions of people, and has the following objectives and contents. First of all, the course provides theoretical explanations and deals with the reality of classifying the growth among countries and regions. Secondly, the course examines major performers and rules, which constitute globalization such as international organizations, global enterprises, global finance, media and NGOs, as well as the history and reality of the international order defined by them. Finally, the course aims for students to understand worldwide issues including the battle for global hegemony, regionalism, immigration and population, science, technology and the environment, conflicts and terrorism.

GS2704 Firm and Society Ⅰ [3:0:3]
One of the major axes in the changes of modern society is the change into a corporate or organizational society, and each society creates its own unique form of corporate society as various factors interchange, including the path of growth experienced by society as well as class structure, characteristics of the financial market and the elite alliance, and family structure. This course attempts socioscientific analysis on companies, which provide the most essential dynamic to a capitalist society.

GS2705 Information Society: Technology, Media, and Popular Culture [3:0:3]
This course first looks at the theoretical discussions that explain the so-called “information society” and also examines the technological aspects related to the rise of the information society as well as the institutional aspects including industrial organizations and media. Then, the course will investigate issues such as interchanges in cyber space, electronic government and governance, changes in corporate structures and labor, democracy and education, information gaps and inequality, intellectual property rights, popular culture and globalization.

GS2706 Transformation of World Politics [3:0:3]
This course examines the transformation of world politics in the early modern era, the Cold War period and the present day and, at the same time, proceed with lectures particularly focused on the relationship between world politics and Korea. The changes in the global politics process are studied in each of the itemized discussions and domains including the survey on the development process of historical facts, growth of world political theory, security order, commerce and development, order in financial currency, order in culture, information, environment and energy.

GS2707 Understanding Otaku and Popular Culture [3:0:3]
Many of the new domains of today’s pop culture are being populated with Otaku-style subcultures in comics, animations, games, light novels, etc. This pop culture phenomenon originating from Japan has overcome borders and is now quite familiar even in Korea with the term, “Odeok,” a derivative of “Otaku.” This course aims to examine the phenomenon and characteristics of Otaku culture, widely regarded as a new cultural phenomenon, by area and case in a historical perspective, and the course aims to understand this phenomenon along with the macroscopic social, political and economic context, as well.

GS2708 Firm and Society Ⅱ [3:0:3]
One of the major axes in the changes of modern society is the change into a corporate or organizational society. This course attempts a socioscientific analysis on companies, which provide the most essential dynamic to a capitalist society. The course will specifically deal with the period after World War II and is limited to students who have already taken <Firm and Society I>.

GS2709 The Modern History of Korean Politics [3:0:3]
This course will overview modern Korean political history and treat major political issues from the President Lee Seung-man to Park Geun-hye period. The course will generally consist of videos, lectures and presentations. The themes include Korean politics in history after independence from Japan, important scenes and election results of Korean politics, profiles of political leadership, myths and reality of the developmental state and the South Korean economic miracle, the democratization process during the eight presidents' ruling periods, and so forth. As a consequence, the course will expose students to contending views and empirical reality regarding Korean politics first hand.

GS2724 Macroeconomic Theory [3:0:3]
This course aims for students to understand the decisions of macroeconomic variables, which include national income, capital formation, unemployment, interest rate, exchange rate, trade balance and inflation, as well as the correlation among these variables. Major contents of the course include the fundamental theory on the determination of national income, variables affecting economic growth, macro-economic theory of open economy, financial and fiscal policies for the stabilization of the economy, and trade-off relationship between inflation and unemployment.

GS2725 Welfare and Fiscal Policy [3:0:3]
This course aims for students to learn about the theoretical background of social welfare policies and the social welfare system of our nation to be able to understand what proper social welfare policies look like. As social welfare policies have become a society-wide issue, students will study political measures, etc. needed to create and implement「sustainable welfare policies」whose good functions are maximized while adverse functions are minimized. Going beyond the appropriateness of social welfare, the course looks to enlighten students on the theoretical and political background on its relation with finance.

GS2726 Understanding of the Global Economy [3:0:3]
This course aims to study how the global economic system operates to raise the level of understanding in the globalized economy of the present. By learning about WTO, a global trade system; international balance of payments in the global financial system; foreign-exchange market and currency rate-operating organizations; and issues in the global economy such as financial crises of EU member nations, students are posed to gain knowledge in the field of the global economy needed to live in the era of globalization. Through this, the course looks to teach students the close ties between the domestic economy and the global economy.

GS2727 East Asian Economy [3:0:3]
This course aims to introduce the East Asian economy and, for this, students will first learn the fundamental theories of the global economic order and economic integration, and then examine the regionalism and economic integration of East Asia. Then, the economies of Southeast Asian countries, China and Japan are examined to increase the level of understanding in the local economies of East Asia. Moreover, students will learn our nation's policies of commerce and the FTA and think about the possibility of economic integration by Northeast Asian countries.

GS2728 Economic Policy in the Era of Globalization [3:0:3]
This course introduces the economic characteristics and ripple effects of globalization. The global financial crisis that occurred in 2008 had a significant effect on our country, and students of this course will be asked to examine the root-cause, path of spread and ripple effects of the global financial crisis to be able to understand both the advantages and issues of globalization. Students will study various criteria that can measure the performance of economic policies, and learn about the reasons why a market fails as well as the theoretical background for the government's intervention to improve the performance.

GS2729 History of Economic Thought [3:0:3]
To comprehend the overall flow of economic thoughts, this course will deal with the ancient economic thought, the Medieval economic thought, the classic school, the historical school, socialist political economy, and modern and contemporary economics. In particular, in-depth lectures will be conducted with a focus on contemporary economics and students will read *The General Theory of Employment, Interest and Money* written by Keynes as well as the books of Hayek.

GS2730 The Economics of Foreign Countries [3:0:3]
After learning the basic concepts of economic integration, students of the course will study economic integration and international economic order, the theoretical background and reality of regionalism, multilateralism and new regionalism. Then, they will examine the economic integration between East Asia and Northeast Asia, economic trends in Japan and China, European economic integration and the economies of core member nations, North American economic integration (NAFTA) and the economies of its member nations.

GS2731 Microeconomic Theory [3:0:3]
This course aims to have students understand the fundamental principles of microeconomics, which forms the basis to comprehend the economy and be equipped with economic thinking. In particular, the course explores the supply and demand in the market, competition and monopoly, the game theory and strategic actions, risks and information, market failure and the role of the government. Interesting real-world cases that can be explained by microeconomics will be introduced, and classes will be based on lectures but will also include a variety of interactions such as debates and cooperative problem solving.

GS2732 Behavioral Economics 1 [3:0:3]
A human being has been regarded as a rational economic subject in traditional economics textbooks, and this course explores how a human behaves in reality, why a human behaves in such a way and what are the ramifications of such behaviors. Through this course, students will be able to realize the diverse and systematic errors contained in human psychology and actions and understand the phenomena in which such errors move the economy and change society while learning how to better control their own emotions, judgments, actions and personal relationships.
(※ The follow-up course centered on applications and policies is Behavioral Economics 2)

GS2733 Behavioral Economics 2 [3:0:3]
As a follow-up course of Behavioral Economics 1, this course aims to have students understand human psychology and behavioral patterns as well as actual cases in which policies utilizing these have been applied, thus exploring and practicing the ideas that help raise the level of welfare of humans and the public. Students of this course will form teams and participate in projects in which they develop and execute various nudge ideas that can contribute to schools, communities and, even, the country and the world.

GS2734 Conditions of Happiness [3:0:3]
This course explores ways to improve the quality of life and happiness based on actual research results of Economics of Happiness, a subject that studies factors determining the happiness of individuals and society. Also, the course reviews and debates on the discovery of Positive Psychology, which focuses on the positive aspects and growth of human psychology, and pieces of wisdom found in classical texts on happiness. Through this, students will deeply think about the conditions and meaning of happiness and investigate practical ways in pursuit of a balanced life, inner growth and peace.

GS2735 Economic Development in Korea [3:0:3]
By systematically learning about the industrialization process since the 1960s, this course aims for students to clearly understand the achievements and limitations of economic development in Korea. The course also pinpoints why Korean economic development policies were successful unlike those of many developing countries and talks about the reasons why the Korean economy is facing its current issues, thus raising the level of understanding in the present economy.

GS2736 Unified Germany and Unification of Korea [3:0:3]
This course studies the economic integration of East and West Germany, a reform of the East German system for economic integration, and the socioeconomic impact of unified Germany before reviewing the scenarios of unification of North and South Korea. For each unification scenario, students will investigate its effect and implications on the economy, social welfare, population, etc.

GS2742 Human Mind and Human Behavior 1 [3:0:3]
The course aims to introduce the nature of scientific psychology and understand how the basic behaviors and mind of a human work together. In particular, students will learn about human behaviors in a wide spectrum, from the communication process of neurons to the metacognition process such as language processing, to be able to add a greater depth to their understanding of human behaviors and, furthermore, naturally encounter different case studies of convergence research, one of the major characteristics of psychology, to cultivate thinking of consilience.

GS2743 Human Mind and Human Behavior 2 [3:0:3]
This course teaches the human personality, development, behaviors in a society, motivation and emotion, abnormal behaviors and treatment, thus seeking a more in-depth understanding of humans. Also, through cross-cultural psychology, the psychological characteristics of Koreans are understood, and how psychology is being utilized in other areas of real life is introduced as well.

GS2747 The Psychology of Human Relationships [3:0:3]
This course aims for students to understand the process of people's diverse personal relationships with a scientific methodology. By investigating the basic theories of social psychology, the course introduces how theories are applied to actual personal relationships. In particular, the course introduces scientific research on what may be of a special interest to college students – friendship, love and personal relationships at work (labs) - in order to provide a foundation for students to foster mature personal relationships.

GS2748 Language and Mind: Psycholinguistic Approach [3:0:3]
This course aims to explore a human's language information processing process to understand the nature of the human mind. The course examines the representation on the cerebrum during the process of understanding and calculating language, and also studies language development, the mind and cognition of bilingual speakers, the relationship between language and thinking as well as between language and culture.

GS2750 Principles of Management [3:0:3]
As an introductory course to Business Administration, this course forms the basis of intensive curricula of business administration such as strategic management, organizational action, entrepreneurship and technological management. Learning in this course is performed through various theories and case studies on management and entrepreneurs. Since those who study business administration for the first time lack knowledge system in which they can systematically understand and acquire new information, this course aims for the students to become equipped with a comprehensive knowledge system on business administration as a whole.

GS2751 Strategic Management I [3:0:3]
Strategic management is a subject that talks about how a company can maintain a sustainable competitive edge. This course aims for students to inquire into the source of a sustainable competitive edge and features a variety of curricular activities including case studies in order for students to effectively study the concepts and theories of business and corporate strategies. The objective of this course is to obtain clear understanding of strategic actions of renowned companies and their significance from a business administration standpoint, and the mechanism of such strategic actions contributing to the success and failure of companies.

GS2752 Strategic Management of Technology and Innovation [3:0:3]
In recent years, nearly all companies concentrate their efforts in achieving more technological innovations and, subsequently, a company's accurate understanding of strategies and management of technological innovation has begun to regarded as an extremely important element that determines the company's survival. This course aims to deliver a systematic and consistent knowledge system on the strategies and management of technological innovation to students majoring in engineering.

GS2761 Human Rights Law: Issues in Human Rights in Contemporary Society [3:0:3]
This course aims (for students) to introspect modern society from the standpoint of human rights and human rights laws. In this course, students will try to understand various human rights issues faced by individuals and groups and those generating significant controversies today, and debate on these issues in connection to relevant laws and precedents. By especially considering the unique and vivid reality generated in various domains of Korean society, the course focuses on developing an introspective and critical view on Korean society. Moreover, the course provides an opportunity to train students on the ability to logically and analytically think about the aforementioned issues of controversy.

GS2762 Law and Justice: Ideas and Reality [3:0:3]
This course aims to provide students with intensive learning on the essence of the modern theory of justice. The course will include libertarianism and utilitarianism, and allows students to read and compare the theories of justice by John Rawls and Michael Sandel in particular. Furthermore, the course compares its legal definition with this social definition to think of their importance.

GS2763 Understanding Contemporary Law and Legal Studies [3:0:3]
This course takes a view of law and legal studies in general (with a focus on contemporary Korean laws). The course aims for students to comprehensively understand present-day laws centered on core areas of contemporary laws and legal studies, including the constitution, criminal laws and civil laws. This course is recommended as a common basis before enrolling in other subjects related to law and legal studies (although it is not required to take the course as a prerequisite).

GS2764 Contemporary Legal Philosophy [3:0:3]
This course aims at students gaining a fundamental and comprehensive understanding of contemporary legal thoughts and philosophy. The course seeks to take an approach by major topic instead of an approach by era or character. The course will examine not only traditional controversies such as the conflict between legal positivism and theory of natural law, the issue of legal inferences and interpretations, and constitutionalism but also contemporary issues on the law and gender, law and information, law and the environment, among others. Therefore, the course will provide the basic grounding on legal thoughts and philosophy and, at the same time, be beneficial in introspectively understanding the positive laws and systems.

GS2765 Constitutional Law and the State [3:0:3]
This course aims for students to gain understanding of the functions and structure of a nation and politics, which is the major foundation of the Korean constitution. Understanding how a nation and its politics work and how its principle of governance is established is the required virtue for all citizens today. The existing constitution of Korea proposes how the ideas of freedom, equality, human rights and democracy for all citizens can be realized through a political system. With this understood, how is the reality of politics in present-day Korea? This course offers the opportunity to critically reflect on this question.

GS2766 Constitutional Law and Fundamental Rights [3:0:3]
This course aims to offer students proper understanding of fundamental rights, which is a major content of the Korean constitution. The constitution of Korea places the ideas of freedom, equality, human rights and democracy for all citizens as the fundamental principles of the nation's formation. This course will examine how these are realized through the concept and legal principles of fundamental rights.

GS2781 International Relations Ⅰ: The Rise and Decline of the Modern State System [3:0:3]
This course first reviews the Western sovereign states, which are the basic subjects for international relations research, as well as the process of international order's formation, growth, settlement, expansion and structural changes into the 20th century. Modern states began from absolutism, experienced revolutions due to frequent wars and achieved a qualitative transformation into modern nation-states, which greatly intensified conflicts and ultimately led to all-out wars such as World War I and II. As a result of such all-out conflict, world politics went beyond Europe and spread around the globe, and all regions of the world have been restructured by the frame of a modern nation-state. Also, the conflicts have progressed mainly around the battle between two superpowers of the U.S. and the Soviet Union, the discussion of which will lead to International Relations II.

GS2782 International Relations Ⅱ: The Globalization of World Politics [3:0:3]
Lectures of International Relations II will review the process of the nuclear arms race, which was carried out fiercely between the U.S. and the Soviet Union during the Cold War era, and examine the political outcomes of the Cold War and its collapse while also reviewing developing countries' issues of modernization, which was carried out within this context. Various controversies that had been suppressed by security issues during the Cold War erupted once such pressures were removed, and these controversies include the environment, terrorism, nuclear proliferation, nationalism, culture, humanitarian international intervention, regional cooperation, commerce and finance, the Internet, fight against poverty and hunger, and gender and human rights. In International Relations II, students will investigate each of these issues to learn that international relations have changed into global politics that deal with the issues of the world, which is now a single community.

GS2783 Technology and War [3:0:3]
Scholars say that war became a necessity in mankind's life along with the civilized life that started about 10,000 years ago. When a war is lost, properties are lost and, in extreme cases, the entire community disappears and all of the community's residents become enslaved. To prevent such an event from happening, all communities in history prepared to secure a victory if a war is deemed inevitable. Such preparation includes the development of warfighting techniques and the tools of battles, or weapons. Development of military technology has already occurred continuously since the ancient times to the present day and, since the late 18th century, science-based military technology has been developed. This course aims to review the technological development process in the midst of the tension of wars and the entire history in which such technology was spread to non-military sectors while non-military technologies were also applied to the military.

GS2784 Understanding of Classical Political Thoughts [3:0:3]
In「Understanding of Classical Political Thoughts」, students will read the books of four of the most representative political philosophers in modern Western history and two of the leaders in the history of Korean philosophy, and explore the process through which humanistic knowledge or political opinions form, along with the background knowledge added and lectured by professors. The ultimate objective of this course is to develop the skills to bring about an agreement from another person through persuasion, a more sophisticated tactic than coercion.

GS2785 State and Civil Society [3:0:3]
Among the three principles that form social order under the capitalist democracy that we live in - "rule by the nation" (nation), "rule by the citizens" (democracy and civil society) and "rule by capital" (capitalism and market), this course discusses the principles of organization and operation of a nation and civil society as well as the relationship between a nation and its civil society. As might be expected, the course will also talk about how the rule by the market and capital comes into conflict and, at the same time, coexists with democracy and the autonomy of the nation. However, the focus will be on the relationship between a nation and its civil society, and the relationship among a nation, civil society and capital (market) will be primarily dealt with in the [Theories of Political Economy] course.

GS2786 Theories of Political Economy [3:0:3]
As the boundary between political phenomena and economic phenomena becomes blurry under the political economy of contemporary capitalism, politics and economy, which had existed as separate areas with independent domains, interests and methodologies, are being integrated into a so-called political economy. This course primarily aims for students to understand various theories on politics and economy, or the relationship among a nation, democracy (civil society) and capital (market) to be more specific. First, the course examines the political economy approach and the political sociology approach, which analyze the economic phenomena of politics and the political phenomena of economy. Afterward, the course will analyze democracy and capitalism, failures and reforms of socialism, structure of class compromise in a capitalist country, and the relationship between globalization and democracy.

GS2787 Theories of Korean Politics [3:0:3]
This course is a liberal arts class that aims for students to understand Korean politics through a comparative approach with the political history and political economy of Korea. First, the course will discuss how to comprehend Korean politics. After reflecting on how the theories of Korean politics cannot assume a mainstream position even in Korean political science and how it fails to achieve innovation in its methodologies and contents, students will take the comparative political history and comparative political economy methodologies to discuss the modern politics of Korea in the order of the Japanese occupation era, liberation, Korean War and the 50s, development dictatorship in the 60s and 70s, warlordism dictatorship in the 80s, democratization and the 3-Kim era, globalization and new liberal democracy in the age of IT revolution, the regression of democracy and impeachment of the Park Geun-hye regime, and the Korean democracy resurrected by the Candlelight Revolution.

GS2788 Theories of Democracy [3:0:3]
In Theories of Democracy, the nature and concept of contemporary democracy will be first clarified and the history of different forms of democracy will be reviewed, from direct democracy born in ancient Athens to the liberal representative democracy, which had stopped at Rome's republicanism but was revived after 1,000 years in modern European city-states and bloomed in modern territorial nation-states. The course will also examine the crisis faced today by representative democracy due to the appearance of digital contents and talk about alternative democracy that can replace representative democracy. Moreover, the course will discuss democratization that has been carried out globally since the mid-1970s.

GS2791 Reading Eurasia [3:0:3]
Eurasia is going beyond the mere combination of Europe and Asia and, rather, being highlighted as a unit from the standpoint of civilization history. Thus, this course closely examines Eurasia in the context of civilization history. Moreover, the course will view its present-day definition from the perspective of "One Belt, One Road" and the "Eurasia Initiative" in preparation of the future.

GS2792 Communication Theory I [3:0:3]
Based on <*Theorie des kommunikativen Handelns*>, a key writing of Jürgen Habermas (1929-), the modern-day successor of the Critical Theory, the issues in communication and its rationality are grasped and, through this, the course aims to approach the fundamental understanding of communication.

GS2793 Communication Theory II [3:0:3]
Centered on <*The Gutenberg Galaxy*>, a contemporary classic written by Marshall McLuhan (1911-1980), the course drastically reviews the issue of communication from humanities tradition and, through this, aims to seek fundamental discernment of humans and the world as the main agents of communication.

GS2803 Science, Technology, and Society [3:0:3]
This course overviews the growth of science and technology and explores the social meaning that science and technology have in contemporary society while reviewing the relationship they have with fundamental social domains such as law, politics, economy and culture. Then, the course will look at the social status and roles of scientists and engineers and investigate the complex social controversies and debates resulting from the growth of advanced science and technology in domains like information technology and biotechnology.

GS2804 Energy and Human Beings [2:0:2]
The contemporary industrial society, which relies on the supply of abundant energy sources based on fossil fuels, currently faces serious issues of the depletion of fossil fuels and global warming due to an increase in greenhouse gases. Therefore, a deep, diversified understanding on the energy issue is a must as a next-generation scientist, engineer and leader. Instead of partially understanding the energy issue, the course attempts to comprehend the issue with an integrated perspective that encompasses mathematics, physics, chemistry, biology, philosophy and sociology, and aims to train students on how to critically seek alternatives for the future energy issue.

GS2806 Life in the Universe [3:0:3]
The first item of this course is to learn the expansion of the universe, Cosmic Microwave Background, the observation of the chemical element distribution in the universe as well as the process of the establishment of the big bang theory, which took place over the last century, through the papers of Leavitt, Slipher and Hubble. The course also views the evolution history of the universe from the big bang to the present-day universe through the evolution of particles and stars as well as chemical and biological evolutions. Meanwhile, the evolution process of the universe is understood through the interactions inside particles, among atoms and among particles. The course will also emphasize the core physical and chemical principles related to the birth and evolution of life.

GS2808 Food and Medicine [2:0:2]
Food and medicine account for a significant part of human culture. This course aims to take food and medicine as a topic of academic convergence between humanities (philosophy, literature and psychology) and natural sciences (chemistry and biology) and conduct small, debate-style lectures. During the first part of the course, the awareness in food, medicine and poison is interpreted in the language of philosophy and science and their unity is examined. The latter section of the course will feature discussions on the relationship of food and medicine with humans and their impact on our existence as well as on topics such as food and desire, food and psychology, food as an awareness and not as a substance, and the public perception on food and medicine and its fabrication.

GS2809 The Beautiful Planet Earth [3:0:3]
Earth, the only home we have, is severely hurting from recent environmental issues such as global warming and the destruction of the ozone layer. This course primarily aims to have students clearly understand the nature of these issues and cultivate their ability to propose proper scientific response measures. The focus is on comprehensive understanding of Earth by combining existing Earth-related Geology, Atmospheric Science, Oceanography and Astronomy into a single keyword that is Earth.

GS2810 History of Humanity in the Universe [2:0:2]
This course deals with the important history from the beginning of the universe to the present in a macroscopic and integrated perspective. First, students learn about the scientific and philosophical meaning of the birth of mankind through the big bang, stars and galaxies, the solar system, and the origin and evolution of life. Then, students will understand various evolutions of human civilizations through the generation and growth of human civilizations, regional civilizations and their exchanges, and the development of economic systems. Lastly, our present and future are viewed with a focus on topics of globalization and advanced science of contemporary society. This course emphasizes an integrated perspective going beyond the paradigms of individual studies in order to understand the historical facts of the universe and humans as well as various contemporary issues.

GS2811 Man and the Ocean [3:0:3]
One of the most important constituents of Earth as the planet of life is the fact that Earth is a planet of water and, of course, the most essential storage of water are the oceans. However, an ocean is not a mere static reservoir of water and seawater serves a critical role in making Earth a planet of life through continuous exchanges within the oceans and with the atmosphere. The main purpose of this course is to examine the appearance of the planet of life created by the dynamic characteristics of the oceans and, moreover, investigate the scientific grounds of environmental issues faced by the oceans these days due to human activities and also think about the response measures.

GS2812 Bioethics and Law [3:0:3]
This course aims to have students understand various issues of bioethics, which is the intellectual culture of contemporary society and acute social interest, with a focus on legal and ethical controversies. In the midst of current relevant laws such as the Bioethics Act, Medical Act and Patent Act and their connection with detailed case studies (precedents), the course seeks to share the understanding on each of the issues and conduct joint discussions. Going beyond mere examination of the existing legal affairs, students will critically contemplate on even the issues that are controversial from the standpoint of ethics and legal theory. Moreover, by considering the unique and vivid reality formed in bioengineering research and medical scenes in Korea, the critical mind on this topic is to be sharply honed.

GS2814 Utopian Fiction and Technology [3:0:3]
This course examines Platon's 『*Politeia*』 and Thomas More's 『*Utopia*』 as well as the universe utopia in the latest science fiction, and explores how the ideal of "utopia" has appeared and been developed in Western thoughts and literary imagination. In particular, the course concentrates on the essential role of science and engineering in Western utopia fiction, which imagine the realization of people's happiness (and simultaneously criticize the existing injustice and irrationality of reality) within the non-existing (u-topic) and ideal (eu-topic) society, and also seeks diverse discussions.

GS2815 Culture Engineering I [3:0:3]
Based on the thesis, "Cultural value determines mankind's growth," this course views the relationship between culture and society as well as culture and development from a global perspective. Through this, the course examines how culture is associated with general social changes in order to check the utility of the culture technology awareness frame.

GS2816 Culture Engineering II [3:0:3]
Based on the understanding of the cultural innovation theory and the cultural strategy model, the course aims for students to increase their level of comprehension and interpretation on culture codes that work throughout the living world and, through this, build theoretical and practical competency to pursue more systematized cultural awareness and real cultural innovation.

GS2817 Research on Culture and Urban Regeneration [3:0:3]
This course examines through various case studies how an aging city that has lost its vigor is able to be regenerated and rehabilitated by culture. In doing so, the course aims to newly establish the concept of "Culture-Sphere," a combination of culture and sphere, and focus on and emphasize its importance and potential for utility.

GS2818 Mash-up Thinking [3:0:3]
Demands for mash-up thinking are significant because mash-up thinking is believed to give birth to creativity. Thus, this course aims to comprehensively deal with epistemological and methodological elements on mash-up thinking that stimulates creativity and, furthermore, to closely examine the 13 thinking tools, which enable mash-up thinking, from theoretical and practical aspects. Through this, the course objective is to seek the expansion of real mash-up thinking.

GS2819 On Image: Ways of Seeing [3:0:3]
As we can see from augmented reality (AR) and virtual reality (VR) that approach more real than reality, we live in an age in which the boundary between reality and image continues to disappear. By fundamentally exploring the world of images, this course seeks to proactively understand the continuous changes of the world and build the competency to respond to them.

GS2821 Leadership and Professional Development Project through Public Speaking [2:0:2]
This course aims to cultivate the refined elements of a leader who communicates clearly and definitely through learning about public lectures. It takes a significant amount of learning and exercise to communicate with the audience, build trust and be proficient in lectures containing passion for the delivered contents. This is the method of communication that goes beyond mere factual presentation and corresponds to the educational purpose of GIST College that pursues liberal arts education with creativity and communication as the basic grounding. The major contents of this course include diligent learning of the fundamental principles of public speech, training and recording the process of exercises and execution of major elements and, through this process, completing an hour-long final speech at the end of the semester on the topic chosen by individual students.
Note: All presentations will be video recorded and reviewed by class members.

GS2831 Understanding of STS (1): Issues and Ethics in Socio-technological Controversies [3:0:3]
As science and technology become more frequently debated in public spheres these days, we witness science and technology enter more and more into the center of our political lives. This course aims for students to understand the major research topics of science and technology studies (STS) by examining actual cases of modern conflicts in science and technology. As students explore moral, economic and social issues related to "socio-technological controversies," they will be able to comprehend the characteristics of scientific knowledge and the social role of science and technology.

GS2832 History and Issues of Technoscience [3:0:3]
This course deals with the history and issues of major technologies (railroads, telecommunications, computers, automobiles, etc.) since the industrial revolution to examine the historical process through which today's scientific and technological civilizations have formed. This will help students understand how science and technology interact with society and how the new technological innovations are enabled.

GS2833 Understanding of STS (2): Critical Design [3:0:3]
This course introduces students to basic principles and hands-on activities of Critical Design. Students are asked to understand how technology plays a political role in our daily lives, and engage in practice involved in designing technological prototypes to make a difference in the world.

GS2834 History of Science [3:0:3]
In today's society, science enjoys a great cognitive and social authority. Since when has science enjoyed such authority? This course investigates the long history of science, from natural philosophy in ancient Greece and the European scientific revolution to the rise of contemporary physics and molecular biology, and explores how scientific knowledge has corresponded with social culture and formed its current look. Through this course, students will be able to understand that the scientific knowledge of the West, which claims to be universal, is actually knowledge and practice created within a unique, historical context.

GS2911 Chinese 1 [2:0:2]
In an era where East Asia has become more important than ever in history, exchanges with China is now a necessity. This is the case in the field of science and technology as well. Hence, for a scientist and an engineer, it has become essential to be equipped with the basic understanding of the language and culture of China.
This course aims to allow students who have never learned Chinese before to be able to gain the fundamental comprehension of Chinese. Understanding of Chinese culture and society must begin with learning the language. For this, the course enables to accurately learn Chinese pronunciations as well as basic sentence structures of Chinese to be able to establish a foundation for Chinese conversations. Moreover, the course aims to increase the basic understanding of the present Chinese culture and society.

GS2912 Chinese 2 [2:0:2]
In an era where East Asia has become more important than ever in history, exchanges with China is now a necessity. This is the case in the field of science and technology as well. Hence, for a scientist and an engineer, it has become essential to be equipped with the basic understanding of the language and culture of China, which is also closely related to competitiveness.
This course aims for students with the basic understanding of Chinese to further intensify their comprehension in Chinese vocabulary and sentence structures and, thus, enhance their ability to carry Chinese conversations. Based on this, the course increases the level of understanding in Chinese culture, which can be of practical help in exchanges with Chinese scientists and engineers in the future.

GS2913 Introduction to Classical Chinese [2:0:2]
The most fundamental elements of Chinese and Chinese characters, which make up the common spiritual culture of East Asia, are introduced. Korean vocabulary comprises Chinese vocabulary and pure Korean vocabulary, and more than almost 90% of all technical terms are made of Chinese words. By learning how Chinese language and Chinese characters are formed, students will be able to better understand the major Chinese words used in daily life and the intensive meaning behind science jargons.

GS2931 German 1 [2:0:2]
Germany historically possesses advanced systems in various areas and its academic achievements especially in the field of science and technology has an extremely powerful influence. This course aims for students to acquire the ability to communicate in beginner-level German. By understanding the diverse cultures of Germany and Europe, students are able to strengthen their global skills. The course will be designed by reflecting the needs of the institution and the students and, for example, scientific and engineering German and convergence studies may be included.

GS2932 German 2 [2:0:2]
Germany and Europe possess world-class academic capacities in many different areas, and they have had an immense impact on the history and philosophy of science, which is why the value of their achievements in the field of general sciences is highly recognized. This course aims for students to be able to utilize the German language for beginner-level communication. By studying the cultures of Germany and Europe by topic and promoting the mutual cultural capacity, students are directed toward growing into global talents. The contents of the course will be determined through a discussion with the students and, for instance, may deal with the science and technology policies of the European Union or media culture.

GS2933 Japanese Grammar [2:0:2]
This course offers a chance for students who have learned basic Japanese to learn intermediate-level vocabulary. This is an intensive course for those who have never learned Japanese before but still understand Chinese characters.

GS3001 Real Analysis & Applications [3:0:3]
This is a course that deals with systematic contents of the theory of real functions and introduces contents such as the system of real numbers, limits of real functions, continuity, differentials, integrals and Riemann integral. Students will be able to understand the proof of a theorem that uses ε - δ and learn the fundamental concepts of analysis. The course enables students to develop mathematical and analytical logics and trains their ability to read and write proofs. In addition, the course teaches the applications enabled through real analysis.

GS3012 Mathematical Modeling for Engineers [3:3:2]
During the summer break of 2016, Professor Rachel Levy of Harvey Mudd College, an engineering institution among the renowned Liberal Arts Colleges in the U.S., was invited to hold a mathematics-engineering integrated subject for the undergraduate students at GIST. Originally designed based on the Engineering Mathematics (E72) course, which is currently run at Harvey Mudd College, this course comprehensively teaches students the necessary contents of engineering through demonstrations of actual engineering problems, mini-lectures of mathematical logic that forms the basis of mathematical modeling, group work for increased understanding and, even, numerical analysis through Matlab programming. The course covers mathematical techniques and applicability and especially aims for students to develop virtues such as “mathematical confidence, the ability to differentiate suitable mathematical tools for given engineering problems, discernment on the accuracy of calculated solutions, acquisition of analytical and computational capacity, and patience, which is a necessity in solving complicated problems.”

GS3015 Probability and Statistics [3:0:3]
This course, “Probability and Statistics” (or “Basic Statistics”), studies the basics of statistical thinking for qualitative and quantitative data analyses needed in completing a college curriculum. Also, for students who wish to major in fields that require a great deal of mathematical, statistical or quantitative analyses, this course enables them to be equipped with a numerical foundation of the scientific analysis method and to nurture their capacity to take upper-level courses.

GS3301 Physical Biology of the Cell [3:0:2]
The course primarily aims for students to gain experience in using a quantitative model and solving biological problems. Students use the “Order of magnitude biology” to lean how to study various phenomena of the biological world in simple estimates and also practice utilizing statistical mechanics to learn modeling for a countless number of biological questions. Also, one of the primary objectives of this course is to learn how different topics are related and formed in a systematic shape when these topics, which seemed to have no relation among them when approaching from biological phenomena from the standpoint of molecular cell biology, are, instead, approached from a fundamental different method, or from the standpoint of physical biology.

GS3311 Gene Expression and Analysis [3:0:3]
Gene Expression and Analysis is designed for students to maneuver through a process known as gene expression and analysis to independently set up hypotheses and experiments, execute the experiments, analyze the results, conjecture the conclusion and establish hypotheses for following experiments. As students carry out a series of research process on their own, they will become trained to communicate with their peers on their respective outcomes through oral presentations. In addition, the course requires students to practice writing theses on the obtained experiment results, which may be presented in English academic journals, with their peers, and repeatedly trains students on thesis data search, outline writing and several rewrites through a joint lecture with English native-speaking instructors, thus aiming to guide the students in becoming independent researchers.

GS3501 Yi Sang's Literature and Science [3:0:3]
A multilateral approach is required to comprehensively understand Yi Sang's literature in which arts and science are fused. This course analyzes and researches his poems and novels from a scientific perspective.

GS3502 Writing Poetry [3:0:3]
Through this course, students will learn the basic discussions needed for the creation of poems and write poems every week for joint critique.

GS3504 Modern Korean Authors [3:0:3]
This course aims to broaden students' knowledge and experience of modern Korean authors based on the major theories of authors. The course reviews the existing history of research on authors, and analyzes and explores literary texts with a focus on modern Korean authors. Through this, the course seeks to deepen students' understanding on modern and contemporary history of Korean novels.

GS3601 Rise and Fall of the Great Powers [3:0:3]
Everyone has interest in powerful nations. Together with students who have taken basic topics of history, the course historically examines the heydays and collapses of countries that once formed global empires in various aspects. In particular, the empires of the East and West, which remained powerful since the Medieval period to the 21st century, and their rise and fall are investigated from the perspectives of culture, military, economy and overseas expansion.

GS3602 Topics in History [3:0:3]
One of the characteristics of GIST College is to deepen knowledge in humanities. Students who have entered through the major curriculum with especially keen interest in history are likely to want to take history courses with more depth, and this course allows these students to select a topic from and read about the history of East Asian nations including Korea and, also, to hold debates on their own. The course will also offer training on writing simple seminar papers.

GS3603 Interpreting Historical Sources: Western Experience [3:0:3]
This course is designed for students to read original materials, or historical records, on major topics of Western history, critically interpret them and, furthermore, be trained to propose new perspectives. Students will read historical texts written in both Korean and English and write short papers. The historical records will primarily deal with significant historical events or circumstances such as the Holocaust, the Soviet Union political system and the Cold War.

GS3604 Topics in Western History [3:0:3]
This course allows students to select from the core research topics of Western history to collectively learn about related major research papers and theses in a seminar-style format. Based on the learning outcomes, students will write short papers. The expansion of America as a latter imperialist, which began in the late 19th century, has had a remarkable effect on the history of the West and the world. Students will have the opportunity to systematically conduct research on this process and subsequent challenges.

GS3621 Philosophical Issues in the Twentieth Century 1 [3:0:3]
Philosophically, the 20th century is fundamentally different from the past. The ideological assignments proposed by 20th-century philosophy, which include the West and non-Western regions, enlightenment and anti-enlightenment, rationality and anti-rationality, and consciousness and unconsciousness, still remain as meaningful topics to understand the 21st century. This course aims for students to understand philosophical assignments of the 20th century and, based on these, forecast the ideological direction of the 21st century.

GS3622 Philosophical Issues in the Twentieth Century 2 [3:0:3]
This course aims to have students examine the assignments and methods of contemporary philosophy. In order to achieve this objective, students must, to a certain degree, understand the flow of philosophical and ideological history that proceeded with a focus on existentialism, analytics, structuralism and post-structuralism, which are important schools of philosophy after the mid-20th century. Based on such understanding, students are expected to develop the ability to find alternatives and think about solutions on their own regarding the situations faced by mankind today.

GS3623 Reading Eastern Philosophy Classics [3:0:3]
By reading through Zhuangzi who represents Taoism among Eastern philosophy classics, students of the course will have the opportunity to understand one of the essential positions of Eastern philosophy. In particular, in this course of Reading Eastern Philosophy Classics, students will not just stop at understanding Zhuangzi simply from the standpoint of philosophical theory but also debate on the potential for symbolic analytics on discussions that express thoughts.

GS3624 Invitation to the *"Book of Changes (I Ching)"* [3:0:3]
The <*Book of Chang*es> is undoubtedly one of the most important books in the history of world religion and, for traditional intellects in the Chinese-speaking cultural sphere, was the source from which the meaning of life is contemplated and, also, insight is gained. To people today, however, the Book of Changes is a mere compilation of mysterious symbols. It is indeed difficult for an untrained individual to read the <*Book of Changes*> and discover its meaning. This course aims to propose to its students "hints" to understanding of the <*Book of Changes*> and provide the opportunity to approach the path of Eastern thinking on their own and think freshly about it.

GS3625 Reading *Lao-zi* [3:0:3]
Lao-zi is widely regarded as one of the most important and profound classics in the spiritual history of mankind. To reflect students' demands for an increased level of quality of humanities education at GIST College, a course is to be established that dives deep into reading <*Lao-zi*>, which was briefly mentioned in the course titled <Tradition of Eastern Thinking>. Reading of the original text of <*Lao-zi*> is normally established as a graduate-level course of philosophy; however, the text is worth a challenge for the training of deep thinking for GIST students with a significant amount of intellectual passion. A classic is not just an old book. As they read the original text in the course, students will discover that a text from 2,500 years ago can be re-highlighted as a civilization theory with remarkably contemporary value and gain the experience of restoring their ability to appreciate classics.

GS3631 Minds and Machines [3:0:3]
Can a machine, which is not human, think and feel? Can a computer have consciousness? Traditionally, the exploration of the mind was discussed in the realm of philosophy with a focus on the relationship between the body and mind but, in the middle of the 20th century with the birth of an interdisciplinary study known as cognitive science, it has become a new paradigm to approach and understand the mind as a sort of a computer. This course aims for students to comprehensively understand the major controversies debated in contemporary philosophy of the mind and to review the fundamental assumptions in cognitive science and AI research, thus offering students with the opportunity for a philosophical and inclusive introspection on the nature of the mind.

GS3632 Rational Judgment and Choice [3:0:3]
Inductive logic and decision-making theory is an area that examines the kind of faith one should have and what kind of choice should be made to be rational considering the evidence given in a situation. This course will first introduce the inductive logic and decision-making theory and review basic assumptions and practical applications of this field. One of the curricular objectives is to review a number of puzzles, which may occur in decision-making situations including games and circumstances of group selection, and obtain a greater understanding on rationality. The first part of the course will be centered on lectures by professors while the latter part will primarily feature presentations and discussions.

GS3633 Topics in Philosophy of Science [3:0:3]
This is a seminar-style course that gets students to critically think about the nature of explanation and understanding, especially on the explanation of human behavior. Both in science or in everyday context, human behavior seeks explanation and understanding of the world and people. This course asks what it is to explain something, or what it is to understand and explain each other's behaviors. Starting from Hempel's classical writing on the scientific explanation through Davidson's cause-and-effect theory on the behavior explanation and up to the more recent normative approach that emphasizes rationality and sympathy, students will read and discuss major research papers and theses to find the most plausible answers to the questions.

GS3651 English Ⅲ: Undergraduate Research Writing in Science and Engineering [3:0:2]
Students will practice and build familiarity with the skills and vocabulary necessary for writing professional and academic research papers in English. This course will cover methods ranging from choosing research questions to self and peer editing. Students entering this course should already be able to write an essay in English.

GS3661 Problems in Ethics [3:0:3]
This is an introductory course to ethics and asks what right and wrong really are. We often evaluate our behavior to be right or wrong. But what really makes a right behavior right or a wrong behavior wrong? For example, is ethics mere social consensus? Through this question, the course seeks clarification on morals, standards and, more broadly, the nature of value. The latter part of the course will ask what exactly we are asking when we ask the meta-ethical question, or the question of what is right and wrong.

GS3662 Understanding Asian History [3:0:3]
Centered on the historical development of East Asia, this course offers the opportunity to think about the historical growth and mutual exchanges among North Asia, Central Asia and East Asia. This course offers students with a great opportunity to overcome an ethnocentric view of history.

GS3721 Economics of Education [3:0:3]
Education must be changing people in a better direction by spending the resources of individuals and society (money, time, effort, etc.). This course evaluates education, viewed as a resource distribution process, in a economic perspective, and explores why education has become the greatest dilemma in Korean society and how it could be resolved. The course aims to cultivate knowledge and practices on education through learning of the theories of economics related to education and various empirical studies, presentations and discussions.

GS3751 Social Network and Firm Behavior [3:0:3]
Distinguishing predisposing factors and results of companies' behaviors in corporate and management theories take an extremely important academic position. Recently, social network analysis has received a great deal of academic interest as a tool that helps such distinguishing, and this is because it was recognized that companies originate from a close social relation, or within a social network, instead of a social state of vacuum. Through this course, students will be able to understand the social network theory in the context of companies and learn how this theory may be applied to real-world situations. The ultimate objective of this course lies in obtaining knowledge on how social networks affect companies' strategic decision-making and how they become involved in the process of such decisions being transformed into social and economic achievements.

GS3752 Strategic Management II [3:0:3]
Strategic management is a subject that talks about how a company can maintain a sustainable competitive edge, and is largely divided into business strategies and corporate strategies. While business strategies consider only the tactics in a single business, corporate strategies deal with the issues and opportunities that may be generated over the course of running more than one business, and, as most companies practically operate more than one business, its significance is that much greater. The objective of this course is to obtain clear understanding of strategic action of various conglomerates and their significance from a business administration standpoint, and the mechanism of such strategic action contributing to the success and failure of companies.

GS3762 Reading the Classics of Contemporary Legal Thoughts [3:0:3]
This is a course in which major contemporary classics on legal thoughts are read, and aims to have students extract, read and explain the leading writings of important thinkers. The textbooks are subject to change by semester. Texts subject to reading mainly include the *Pure Theory of Law* by Hans Kelsen, *The Concept of Law* by H.L.A. Hart, *The Morality of Law* by Lon L. Fuller, and *Taking Rights Seriously* and *Law's Empire* by Ronald Dworkin. Therefore, this course will provide not only the basic grounding on legal thoughts and philosophy but also the opportunity to acquire the ability to precisely read classical scientific literature.

GS3763 Themes of Contemporary Legal Philosophy [3:0:3]
This course aims at providing students with a fundamental and comprehensive understanding of contemporary legal thoughts and philosophy. The course seeks to take an approach by major topic instead of an approach by era or character. The course will examine not only traditional controversies such as the conflict between legal positivism and the theory of natural law, the issue of legal inferences and interpretations, and constitutionalism but also contemporary issues on the law and gender, law and information, law and the environment, among others. Therefore, the course will provide students with the basic grounding on legal thoughts and philosophy and, at the same time, be beneficial in introspectively understanding positive laws and systems.

GS3764 Brain and Cognition [3:0:3]
This course explores the cognitive and neural processes that are involved in human information processes such as attention, vision, language, motor control, executive control, memory, and emotion. The course introduces basic neuroanatomy, cognitive neuroscientific techniques, and behavioral measures of cognition, and discusses how to infer the relationship between the brain and cognition. In this course, students will consider evidence from patients with neurological diseases and from normal human participants.

GS3801 Gender in Science and Technology (GiST) [3:0:3]
This course is an intensive, integrated lecture to raise awareness on the "gender" issue, which has been historically constituted surrounding the birth of modern science and dominating all areas of science and technology in various forms up until today. The course aims to have students deeply analyze and debate on various controversies of science, technology and gender from the perspectives of several areas of study and, based on this, prepare a foundation for "diversity education," which is one of the most important values of global education scenes.

GS3802 The Scientist in Literature [3:0:3]
This course looks at various literary works whose protagonists are "scientists" (in today's term) from the Renaissance era to the present and diachronically and officially analyzes and debates on "scientia" in the fundamental meaning of the pursuit of knowledge as well as the perspective on scientists and surrounding controversies, thus seeking introspection on major values that contemporary science aims for and adheres to.

GS3803 Posthuman Shakespeare [3:0:3]
In this course, students read three of William Shakespeare' plays, *<The Merchant of Venice>*, *<Antony and Cleopatra>* and *<The Tempest>*, all of which are classics of world literature and possess important implications from today's perspective of critical posthumanism, and compare and discuss how (post)humans that appear in these works have been reproduced in various platforms of media such as paintings, plays and films from the 18th and 21st century. In doing so, the course aims to have students (1) understand the concept of posthumans and the controversies of critical posthumanism and, at the same time, (2) cultivate their advanced literacy and critical thinking on texts and media.

GS3861 Neuroscience and Law [3:0:3]
Neuroscience, or brain science, is a core area of 21st-century science and technology, and its research connects and expands to, even, medicine and law. Through neuroscience, it is possible to understand how a brain and the psychological process function and how these form the basis of human cognition and behavior, and, as a result, our philosophical, medical and legal understanding of and response to human beings will greatly change. Thus, this course will provide knowledge on how neuroscience is being utilized in legal theories and practices and understanding on what the controversial issues raised are. Furthermore, the course will provide a future forecast on neuroscience laws.

GS3901 Japanese Culture [2:0:2]
Japan is a nation that is in an inseparable relationship with Korea, but is also a country that feels too distant to become close. This is because the historical relationship of a perpetrator and a victim has not been emotionally overcome. Also, it is our interest to see if Japan can maintain the value of existence as one of the world's advanced nations in the future. In order to approach the topic more deeply and objectively, we need to review from the intrinsic aspects of Japanese culture.

GS4002 Complex Analysis & Applications [3:0:3]
This is a course in which the basics of complex numbers and complex functions are learned. Applications of Complex Analysis can be found not only in various fields of mathematics including the number theory and applied mathematics but also in physics. In this course, the definitions of various types of complex variable functions and their continuity, differentiability and analysis based on the computation of complex numbers are studied, and the most important results in Complex Analysis are learned including the Taylor series, Laurent series, Liouville's theorem, Cauchy's theorem, analytic continuation and the Riemann mapping theorem. Also, the course introduces students to the integration, meaning and application of complex functions such as Fourier transform.

GS4003 Partial Differential Equation & Applications [3:0:3]
Partial differential equations is a field broadly used in mathematics, science and engineering, and this course aims to have students develop the ability to apply the knowledge of differentiation and differential equations to modeling and simulations.

GS4004 Abstract Algebra [3:0:3]
This course introduces the group theory, ring theory and field theory, which form the basic concepts of Abstract Algebra. This course allows students to learn abstraction in a more systematically manner and the course also introduces the application of group or field that are used in various other fields.

GS4005 Scientific Programming [3:03]
In this course, students will first learn basic programming languages (C, C++ language, etc.). Students will then learn the fundamentals of scientific programming through the environment for scientific computing and a few real cases including the basic understanding of UNIX OS and visualization, which are for high-performance computing needed to execute computational science.

GS4006 Elementary and Analytic Number Theory & Applications [3:0:3]
This course studies the basic concept and applications of the traditional elementary number theory and the basics of the analytic number theory, which form the basis of the prime number theorem.

GS4007 Geometry Ⅰ [3:0:3]
Based on calculus and linear algebra, this course aims for students to understand Euclidean geometry and non-Euclidean geometry. To study the geometry of curved surfaces, a basic understanding on differential equations is needed and, for the understanding of isometry, a symmetric group is required.

GS4008 Monte Carlo Methods and their Applications [3:03]
This course is an intensive course of the subject of scientific computing, and studies the fundamentals of (dynamic) Monte Carlo Methods needed in the nano age as well as the applications of Monte Carlo scientific research through the characteristics of such methods and several actual cases.

GS4009 Graph Theory [3:0:3]
In this course, students learn about a number of mathematical properties of graphs, which form the foundation of computer and network theories. Students will examine graphs and various relevant basic concepts, tree structure, matching, factor, connectivity, coloring, planar graphs, Ramsey Theory, etc. based on strict proofs, and will also study methodologies such as the Algebraic method and probabilistic method. Also, the course deals with examples in areas in which they are actually applied.

GS4010 Discrete Mathematics [3:0:3]
This course deals with the principles of discrete mathematics and various methods of handling discrete mathematics, which forms the basis of computer theory. Also, the course teaches students the concepts and methods of fundamental logic and formal mathematical proof in need of mathematical thinking.

GS4015 Scientific Computing [3:03]
This course is an elective from general mathematics courses available for selection by students in the majors of natural sciences and engineering who are also interested in computational science. The course begins with the introduction of scientific computing, a mathematical language of computational science, and deals with necessary concepts and application problems. Students will learn the finite element method's initial value problems, boundary value problems, the solution of a system of linear equations, and nonlinear problems, all of which are basic problems in scientific computing. In addition to the finite element method, the Monte Carlo method, a probabilistic methodology, will be introduced.

GS4016 Introduction to Topology [3:0:3]
This course is aimed to offer students a basic introduction to topological properties of spaces, like continuity, convergence, compactness, metric spaces and metrizability. If time permits (although unlikely), the concept of the fundamental group will be discussed.

GS4017 Mathematica & Symbolic Computing [3:1:3]
Over two semesters, this course deals with symbolic computing using Mathematica and applies this to discover the solutions of various problems frequently encountered in mathematics, science and engineering. Main topics include the formula of conversion, equation solutions, differential calculus, vector analysis, discrete mathematics, operator analysis, visuals and graphics. Based on these, students will apply symbolic computing and deal with the associated systems theory, electromagnetism, signal processing, etc.

GS4018 Mathematica for Topics in Mathematical Sciences [3:1:3]
The aim of this course is to have students understand the topics in mathematical sciences and the application of Mathematica including the symbolica package. At the end of each topic, students are required to solve given problems using Mathematica and present their solutions. The first topic is modeling in mathematical biology, namely the Keller-Segel model of chemotaxis. The second topic is simple models in general relativity described using differential geometry. The third topic is fluid dynamics, aiming to understand the Navier Stokes equation, which is regarded as the most challenging PDE. To understand these topics, knowledge in vector calculus and differential equations is required.

GS4301 Evolutionary Biology with Field Trip [3:2:2]
This is one of the short-term intensive courses of seasonal semesters. Through intensive lectures and experiments, this course offers historical background on evolution, which is the basis of contemporary biology, and simultaneously examines how evolution is being understood and explained through the methods of genetics and molecular biology. In addition, students will take a field trip for local lectures and experimental exercises on Lombok Island, one of the main axes of the Wallace Line. As a whole, the course combines lectures at school and on site as well as lectures and experiments, thus maximizing the educational effect.

GS4741 Psychology of Technology and Information Society [3:0:3]
This course was planned to provide students with the understanding on how a person's life is influenced by science and technology. Major contents of the course comprise research and discussion on how diversely science and technology can affect the human mind and behavior from mankind' s fundamental information processing to social issues such as Internet addition and cyber bullying. This course will ask its students to preview the class materials in advance as actual lectures will be carried out as 100% discussions.

GS4761 Ethics of Artificial Intelligence and Robots [3:0:3]
This course deals with ethical controversies surrounding robotics technology, which is arguably the most advanced form of scientific technology. The course aims to present an important opportunity to think about a number of serious moral issues that we either currently face or will encounter in the world of robots and cyborgs in the future. The first part of the course will primarily look at the overview of robotics technology as a whole and talk about general issues of robot ethics including robots' autonomy and responsibilities while the latter part of the course will deal with the individual ethical issues that we will face in the age of robots.

GS4762 Law of Artificial Intelligence and Robots [3:0:3]
This course deals with legal controversies surrounding robotics technology, which is arguably the most advanced form of scientific technology. The first part of the course will summarize the legal issues for each category of application (medical, military and social robots, autonomous driving cars, etc.) of AI robotics technology and the latter part of the course will carry out more itemized discussions on various legal issues (for example, constitutional status of robots, responsibility of robots' behavior for civil damage compensation cases, crimes and penal responsibility, etc.).

GS9301 Freshman Seminar [1.5:0:1]
Freshman Seminar is a course set up to help incoming freshhumans adapt well to college life, be equipped with the fundamental attitude of academic investigation and choose their majors and career paths. The course is operated as a one-credit common required course.

[Overview of GIST College common courses]

UC0201 Volunteer Social Service [0:2:1]
Through volunteer social service activities, the physical and mental difficulties of the marginalized class are experienced in order to understand their circumstances and become enlightened of the importance and meaning of volunteer social service in creating a society in which everyone lives together.

UC0202 Creativity Cultivation [0:2:1]
This course encourages undergraduate students to participate in the "Infinity Challenge" Creativity Cultivation Program and helps them actively accept the changing social paradigm, which includes the advent of the Fourth Industrial Revolution, and grow into creative, integrated talents equipped with creativity, communication, cooperation and problem-solving abilities (3C1P) that the generation demands.

UC0203 Overseas Volunteer Service [0:2:1]
This course provides students the opportunity to realize and practice the value of sacrifice and the spirit of service through participation in overseas volunteer service dispatch programs including the "GIST-NIA joint dispatch World Friends ICT Volunteer Group." Thus, the course helps students grow into global scientists and engineers who know how to understand and respect the lives of others.
※ The criteria for completion must be satisfied as demanded by the particular program including the "World Friends ICT Volunteer Group," and a minimum of 32 hours of community service activities must be performed as well.

UC0301 Mental Health Care [2:0:2]
This course applies the knowledge of counseling psychology on various issues in terms of adaptation faced in today's society, and attempts a realistic approach to achieve better adaptation self-growth. Major topics to be dealt with in the course include self-understanding, self-respect, personality, communication, friendship and love, career, stress management, understanding of major mental disorders, life and death, etc.

UC0901 Science, Technology and Economy [1:0:1]
The economic and social impact of science and technology is addressed in this course. In particularly, the course explores where the greatest major of economic growth is elicited by technology innovation. Most topics having to do with technology entrepreneurship are dealt with by technology entrepreneurs who are pursuing, have pursued or pursued technology ventures ranging from large companies to small- and medium-sized companies. The inspiration given by their experience is beneficial to future scientists and technologists who desire to get involved in R&D or to create their own technology ventures.

UC9331 GIST College Colloquium [1:0:0]
Regarding recent research activities and future directions of research related to each of the areas of major, internal and external experts are invited to hold lectures and discussions where participants talk about various matters of interest.

2. Physics

A. Overview of concentration

The Physics concentration enables undergraduate students of GIST to be provided with a solid foundation, not only in physics but also in various related fields, including electrical engineering, materials engineering, mechanical engineering, optical engineering and bioengineering. The courses offered focus on allowing the students to deeply understand the concepts of fundamental physics in classical mechanics, electromagnetism, quantum mechanics and statistical mechanics. Based on core subjects in physics, a variety of courses have been added that to apply physical concepts to relevant scientific and engineering research areas. Additionally, experiment courses have been prepared for a greater understanding of natural phenomena through the utilization of the physical concepts. Graduates of the Physics concentration are expected to possess the ability to apply the concepts of physics in multidisciplinary research domains.

B. Overview of courses

PS2101 Classical Mechanics and Recitation I [3:1:3]
This course aims to offer students, who have taken General Physics, undergraduate lectures on classical mechanics to have them learn the important concepts and methodologies needed for their major studies in the future, and also improves their application ability through separate exercises. The contents of the lectures will include Newtonian mechanics, conservation of energy and momentum, analytical mechanics, motion in a gravitational field, and vibration and rigid body motion. This course will also examine the utilization of classical mechanics in physics research.

PS2102 Electromagnetism and Recitation I [3:1:3]
This course is the introduction to high-level Electromagnetism. The parts on electric science and magnetism are covered more in-depth and, ultimately, they become integrated into Maxwell's equations. In the process, electrostatics, magnetostatics, electrical and magnetic characteristics of a substance, and electrodynamics will be examined. Additionally, the course enables students to learn and utilize the basics of field theory, which is the most important mathematical technique used throughout physics, through examples of electromagnetism.

PS2201 Introduction to Modern Physics [3:0:3]
This is a first-semester course for students who wish to take on the major of physics, introducing the fundamental concepts in the areas of application related to quantum physics. Major topics to be dealt with in the course include the theory of special relativity, atomic structure, quantum mechanics, hydrogen atoms and molecules, solid-state physics, statistical mechanics, nuclear reaction, and elementary particles. Because these topics will be introduced at a fundamental level, even students who possess relatively low knowledge in related fields will be able to cultivate their understanding and physical intuition on the topics to be examined in this course.

PS2202 Classical Mechanics and Recitation II [3:1:3]
This is the second-semester course of the standard, one-year Classical Mechanics college curriculum for students who have completed General Physics I and II as well as Classical Mechanics I. This course deals with motions of particles by centripetal forces such as Kepler's motion and Rutherford scattering, motion of systems of many particles, the theory of special relativity, relation between symmetry and conservation, rigid body motion, oscillator, vibration in a string, wave equation, etc.

PS3101 Electromagnetism and Recitation II [3:1:3]
This is the second-semester course of the one-year Electromagnetism curriculum for students who have completed Electromagnetism and Recitation I as part of the Division of Liberal Arts and Sciences curriculum. Major topics to be dealt with in the course are behaviors of electromagnetic radiation in a vacuum and a medium, behaviors of electromagnetic radiation in a confined domain, dispersion and absorption, potential and electromagnetic field, light radiation, electrodynamics and relativism.

PS3103 Quantum Physics and Recitation I [3:1:3]
This course provides the basic principles and a theoretical foundation for quantum mechanics, which is absolutely needed to understand modern physics. Major topics to be dealt with in the course include classical mechanics and its limitations, the beginning of wave mechanics and the uncertainty principle, basic hypotheses in quantum mechanics, the Schrödinger equation, eigenfunction and eigenvalue, one-dimensional problems, general structure of wave mechanics, operator methods in quantum mechanics, and N systems of particles.

PS3104 Quantum Physics and Recitation II [3:0:3]
This is the second-semester course of the one-year Quantum Physics curriculum for students who have completed Quantum Physics I. Major topics to be dealt with in the course include the Schrödinger equation in three dimensions, angular momentum, equation of radiation, hydrogen atoms, three-dimensional periodic oscillations, charged particles in an electromagnetic field, spin, identical particles, total angular momentum, molecules and molecular structure, non-degenerate and degenerate perturbation theories, time-independent and time-dependent perturbation theories, collision theory, and radiation absorption in a medium.

P53105 Thermodynamics and Statistical Physics [3:0:3]
This course will provide the basic concepts of thermal and statistical physics. Major topics to be dealt with in the course are probability, introduction of statistical mechanics and thermodynamics, calculation of average values in random walk questions, Gaussian probability distribution, statistical depiction of systems of particles (statistical ensemble, basic assumptions of statistical mechanics, probability calculation), laws of thermodynamics, probability distribution in classical and quantum systems, micro-canonical, canonical and grand canonical partition functions and related thermodynamics potential, the theory of dynamics of a thin gas at an equilibrium, dynamics between phase and chemical species, quantum statistics of ideal gas, interacting system of particles, and the fundamental theory of dynamics in the process of transportation.

PS3106 Experimental Physics I [1:4:3]
In this course, students will execute a variety of basic experiments that help verify many of the aspects of the principles of modern physics in relation to renowned scientists of physics like Rutherford, Franck-Hertz, Hall, Doppler, Fraunhofer, Faraday, Compton, and Stern-Gerlach. Experiments will be carried out in teams that choose the topic of their experiment, etc. and the course will evaluate students with emphasis on basic experiment techniques, data analyses, writing and presentation of experiment results.

PS3107 Mathematical Methods of Physics I [3:0:3]
This course deals with various topics corresponding to basic- and intermediate-level mathematical physics. The course focuses on the understanding of fundamental principles rather than arithmetic calculations.

Principle of coordinate transformation
- Understanding of scalar field and vector field based on coordinate transformation
- Divergence, curl, gradient, Laplacian, etc. in a general coordinate system
- Comparison of Sturm-Liouville system and self-adjoint operator
- Fourier, Laplace, Legendre transformation, etc.

The course concentrates on the understanding of these fundamental principles instead of their meanings, theorems and arithmetic calculations.

PS3202 Electronic Circuit [3:0:3]
This is a course that comprises of both lectures and experiments that deal with “working” electromagnetism emphasizing analog electromagnetism. In this course, students will study RC circuits, diode circuits, transistor circuits, electrical oscillations, op-amps, logic gate and flip-flop.

PS3203 Computational Physics [3:0:3]
This course was established to promote the ability to utilize computers for research in physics. Major topics include basic numerical analysis, Monte Carlo methods, basic signal analysis method, parallel processing, neural network method, and basic concepts of computer devices.

PS3205 Introduction to Optics [3:0:3]
This course offers students fundamental knowledge on the properties of light including its absorption, refraction, scattering, coherence, polarization and diffraction. Moreover, students in the course study Maxwell's equations, Jones Vector and Matrix, ray tracing, Fourier transform, etc.

PS3206 Mathematical Methods of Physics II [3:0:3]
This is the second-semester course of the one-year Mathematical Methods of Physics curriculum for students who have completed Mathematical Methods of Physics I. The course introduces a variety of topics in mathematical methods of physics as follows:
- Ordinary differential equations, calculus of variations, tensor analysis, special functions, complex functions, probability and statistics

PS4202 Semiconductor Physics [3:0:3]
This course introduces the principles of electronic structure, transport and optical properties of semiconductors, and looks at PN junction, dipolar transistor, MOSFET, MESFET and the fundamental principles of relevant photoelectric devices. Also, students in the course will study the energy band theory, creation of carriers, recoupling, quantum transport, etc.

PS4203 Introduction to Biophysics [3:0:3]
Biophysics is a subject that applies the theories and methods of physics to study biological systems. The course will introduce various physics and chemistry theories and methodologies related to molecular biology, cell biology, bioenergetics, biological fluorescence, biomembrane biophysics, molecular biophysics, cytotropism, penetration and transport of biomolecules, etc.

PS4204 Experimental Physics II [1:4:3]
In this course, students will execute a variety of basic experiments that help verify many of the aspects of the principles of modern physics in relation to renowned scientists of physics like Rutherford, Franck-Hertz, Hall, Doppler, Fraunhofer, Faraday, Compton, and Stern-Gerlach. Experiments will be carried out in teams that choose the topic of their experiment, etc. and the course will evaluate students with emphasis on basic experiment techniques, data analyses, writing and presentation of experiment results.

PS4205 Nanoscale Physics [3:0:3]
This course offers students an in-depth understanding of physical phenomena and its applications of nanotechnology. Major topics to be studied are the manufacturing and physical properties of zero-dimensional, one-dimensional and two-dimensional nanosystems including quantum dots, nanowires and carbon nanotubes as well as optical microscope technology in the nano-domain, near-field optical probes and surface plasmons.

PS4206 Nuclear and Particle Physics [3:0:3]
This course studies the formation of atomic nucleus, major properties of nuclear force, types and interactions of basic particles, symmetry, symmetry breaking phenomenon, etc. The course also includes basic terminology of nuclear physics and particle physics, experiment devices, atomic nucleus model, nuclear reaction, interaction between lepton and hadron, and recent issues in the unified field theory.

PS4207 Solid State Physics [3:0:3]
This course introduces physical concepts for the understanding of the medium characteristics of solids. This course dives deeper into the crystal structure, reciprocal space, diffraction, photons, electronic band theory, Fermi surface, etc., and discusses the physical properties of metals, semiconductors, magnetic substances and dielectric media based on the fundamental concepts of solids.

PS4208 Introduction to Astrophysics [3:0:3]
This course discusses physics related to the solar system, galaxy, interstellar matters and the universe. Topics of the course include the formation of satellites and stars and the evolution of stars from white dwarf stars and neutron stars to the black hole. The course will also talk about cosmology and the history of the universe.

PS4209 General Relativity [3:0:3]
This course deals with elementary contents on the theory of special relativity as a whole, tensors and general relativity. Through the course, students may replenish and strengthen fragmentary pieces of knowledge in relativity, which has been mentioned in other subjects of physics, and prepare a foundation for intensive courses such as general relativity and cosmology.

PS4211 Advanced Mechanics [3:0:3]
This course is established for the upper-level undergraduate curriculum and the first-year graduate curriculum in physics and optical science, and will teach students 1) the principle of least action, 2) the theory of special relativity, and 3) the kinetic theory of stress tensors as well as the differentiation among angular momentum, classical spin and quantum spin.

PS4212 Soft Matter Physics [3:0:3]
This course provides knowledge on the properties of soft matters that can be understood by the basic principles of physics from the perspective of fundamental phenomena and structure. In particular, the course will deal with the substances for the explanation of liposomes in the living body, monomolecular (2-d) surface tension, and the principle of self-assembly. The course will also introduce the fundamental physical thinking method on polymers such as DNA, new structures formed by anisotropic objects, and phenomena taking place in limited spaces.

PS4213 Current Topics in Soft Matter Physics [3:0:3]
Many of the soft matters are dynamic and possess a system with a non-equilibrium steady state. Explaining such materials is not possible by a conventional approach. For a number of active cases, this course will explain Molecular motors, Molecular chaperons, Swimmers in low Reynolds number, Cell adhesion and mechanics, and Collective behavior in active systems, and introduce new methods and experiments.

PS4214 Advanced Quantum Physics [3:0:3]
This is an advanced course for students who studied undergraduate quantum physics. The contents are largely divided into four topics.
1) Application of symmetry and group theory in quantum mechanics
2) Understanding of quantum mechanics by using the Feynman path integral method
3) Relativistic quantum mechanics and Dirac's theory
4) Quantization of fields and its application to particle physics and condensed matter physics

PS4215 Introduction to Plasma Physics [3:0:3]
This course lectures on the introductory knowledge of plasma physics, which is utilized in diverse fields such as Super Strong Laser Science, Astrophysics and nuclear fusion, and presents the latest applied research.

PS4216 Special Topics in Solid State Physics [3:0:3]
This course enables students to study phenomena such as the Fermi surface of metals, superconductivity, magnetism, dielectric substances, surface and interface physics and nanophysics, and also teaches students basic theories and detailed experiment methods. The course aims to provide fundamental knowledge in various research areas of solid state physics for undergraduate students or incoming graduate students who wish to major in condensed matter physics at the graduate level.

PS9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

PS9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

PS9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

3. Chemistry

A. Overview of concentration

The Chemistry concentration curriculum encompasses established subjects that form the basis of chemistry and those needed in the relevant fields of materials, the environment and biology. Concentration courses include Physical Chemistry, Organic Chemistry, Inorganic Chemistry, Analytical Chemistry and Biochemistry; these courses focus on topi cs such as the atomic structure, chemical bonds, molecular and crystal structure such as . Also, there are courses on solids, liquids, gases and solutions, which deal with states of substances, as well as courses on chemical reactions including Thermodynamics, equilibrium, stoichiometry and kinetics. Education in Introduction to Materials Science and Engineering, a field which has recently been experiencing high R&D demand, in the field of environmental science is also provided as a course. Moreover, the courses include basic theories, structural analyses, calculation models, organic syntheses and various device analyses.

B. Overview of courses

CH2101 Analytical Chemistry [3:0:3]
This course provides students with the understanding in the basic principles of qualitative and quantitative analyses used in several areas of chemistry and science. The first part of the course will deal with the methods of analysis of data obtained by scientific measurements as well as the fundamentals of statistics. Then, students will learn about the background theories of various qualitative analysis methods and study cases in which analytical chemistry is applied in life sciences and environmental science outside of chemistry.

CH2102 Physical Chemistry A [3:0:3]
This course comprises the introduction and application of quantum mechanics, and reviews the process of the establishment of the quantum theory while examining how quantum theory is applied in simple structures such as hydrogen atoms. The course expands such discussions to allow students to understand chemical bonds at the molecular level and solidify their theoretical background of molecule spectroscopy.

CH2103 Organic Chemistry Ⅰ [3:0:3]
This course introduces the fundamental concepts of chemistry to gain an understanding of organic molecules, which are a constituent substance of living organisms and are closely related to our lives. An important purpose of this course is to learn the relationship between the structure and reactivity of organic molecules, and other topics dealt with in the course include chemical bonds, nomenclature, isomers, stereochemistry, functional groups, spectrometry, and synthesis and reaction mechanisms. After completing this course, students will have obtained basic concepts in understanding the structure, properties, reactivity, etc. of molecules and substances that they will encounter in other subjects.

CH2104 Physical Chemistry B [3:0:3]
This course comprises the introduction and application of quantum mechanics, and reviews the process of the establishment of the quantum theory while examining how quantum theory is applied in simple structures such as hydrogen atoms. The course expands such discussions to allow students to understand chemical bonds at the molecular level and solidify their theoretical background of molecule spectroscopy.

CH2105 Synthesis and Analysis of Organic and Inorganic Compounds [1:4:3]
This is a course in which students learn about the process of synthesizing and analyzing notable inorganic and organic chemicals in laboratories. Students will be able to understand reaction mechanisms and reaction speed through the understanding of physical chemistry properties of reactants and products, preparation of reactants, installation and control of reactors, and analysis of synthesized products.

CH3104 Physical Chemistry II [3:1:3]
This course comprises the introduction and application of quantum mechanics, and reviews the process of the establishment of the quantum theory while examining how quantum theory is applied in simple structures such as hydrogen atoms. The course expands such discussions to allow students to understand chemical bonds at the molecular level and solidify their theoretical background of molecule spectroscopy.

CH3106 Biochemistry Ⅰ [3:0:3]
This course deals with chemical and physical properties of substances constituting a living body. The course will briefly cover essential topics such as the properties of aqueous solutions and thermodynamic properties, and focus on discussions on amino acids, proteins, nucleic acids, carbohydrates, chemical properties and structure of lipids, roles and chemical reactions in cells, etc. The course also introduces the usage of fundamental bioinformatics, which is necessary for biochemistry research.

CH3107 Inorganic Chemistry [3:0:3]
This course aims for students to understand the basic concepts and theories of Inorganic Chemistry. Thus, the topics of the course include major theories and contents related to molecular structure, chemical bond and solid structure discovered in the fields of coordinate covalent bond chemistry, organometallic chemistry and bioinorganic chemistry.

CH2201 Organic Chemistry II [3:0:3]
This course goes deep into the relationship between organic molecules' structure and reactivity based on what has been learned in Organic Chemistry I. Students will first learn about aromatic compounds, compounds including alcohol, aether and carbonyl group, the reactivity of functional groups such as carboxylic acid derivatives and amine, and the latter part of the course will introduce students to biomolecules including carbohydrates, proteins and nucleic acids. Through this, students will be able to understand the reactivity, synthesis and functions of organic compounds.

CH3202 Aquatic Equilibria [3:0:3]
Understanding chemical equilibrium in an aqueous solution in which acid-base and reduction-oxidation complexation simultaneously occur is a prerequisite to understand the interactions among chemical species that exist in an aqueous solution as well as the chemical equilibrium within the solution. In this course, students learn how to graphically express thermodynamic equilibrium of acid-base, complex salt, solubility and reduction-oxidation in an aqueous solution and to explain chemical phenomena in various water environments through schematic analyses.

CH3205 Physical Organic Chemistry [3:0:3]
The course enables students to understand organic chemistry reaction mechanisms by using orbital and stereochemistry.

CH3207 Advanced Chemistry Lab [1:4:3]
This course deals with the principles of measurement of physical and chemical properties of substances, operating principles of various chemistry devices and methods of analyzing measured data through diverse experiments based on Physical Chemistry and Analytical Chemistry. In this course, students engage in basic forms of spectrometry such as FT-IR, Raman and fluorescence as well as electrochemical analyses to investigate various characteristics of substances like enzyme reactions and excited state dynamics, and learn about the composition, programming and operation of basic equipment constituting chemical devices, which helps obtain the fundamental knowledge and techniques needed to carry out various research in chemistry.

CH4205 Bioorganic Chemistry [3:0:3]
The first part of the course deals with the structure and chemistry of monomers of biomolecules, which include amino acids/proteins, carbohydrates/oligosaccharides, and nucleotides/nucleic acids, and biopolymers. Students will be able to comprehend the path and mechanisms of biosynthesis of such biomolecules, and study the reaction within living bodies with which enzymes and ristocetins are involved. As relevant topics, bio-mimetic chemistry, macromolecular chemistry and medicinal chemistry will be briefly introduced in the latter part of the course.

CH4211 Statistical Mechanics in Chemistry [3:0:3]
This is an introductory course to undergraduate-level statistical mechanics and an important course of Physical Chemistry, which connects quantum mechanics and thermodynamics. As an important tool for the understanding of numerous chemical phenomena, Statistical Mechanics is an essential course for students who wish to major in Physical Chemistry in the future.

CH4212 Quantum Chemistry [3:0:3]
Quantum Chemistry delivers the knowledge of advanced quantum mechanics for chemistry and introduces calculation methods of atomic and molecular modeling to upper-level undergraduate students. Lectures in the first two weeks will review the basic concepts of quantum mechanics, and the subsequent part of the course will deal with the understanding and calculation methods of single-electron atoms, many-electron atoms, molecules made of two atoms and, furthermore, electronic structure of typical molecules.

CH4213 Instrumental Analysis [3:0:3]
This course offers students the basic understanding of operating principles of modern analytical instruments. In the course, students will learn about different methods of segregation analyses such as gas chromatography, liquid chromatography and capillary electrophoresis, and have the opportunity to present their research papers on instrumental analysis.

CH4215 Chemical Kinetics [3:0:3]
This course aims to deliver the necessary knowledge in understanding a number of chemical reaction occurring in laboratories to upper-level undergraduate students and graduate students who are majoring in chemistry. The course will introduce major concepts related to reaction speed, and study how to induce mathematical expressions. Students will be required to work on and submit homework assignments given on a regular (occasional) basis.

CH4216 Synthetic Organic Chemistry [3:0:3]
This course looks at classic examples of total synthesis of natural substances and teaches students how to synthesize complex natural substances by utilizing basic organic synthesis reaction.

CH4219 Biochemistry II [3:0:3]
This course deals with the creation and storage of bioenergy, biosynthesis, and control during decomposition with a focus on bioenergy metabolism that takes place in cells. The course comprises 1) understanding the concept of biometabolism, 2) biosynthesis, biodegradation and storage of sugar, 3) biosynthesis and biodegradation of lipids and steroid, 4) biosynthesis of amino acids, 5) biosynthesis of nucleic acids, 6) integration of metabolic activities, and many more, and also introduces related enzyme reactions and diseases.

CH4220 Physical Chemistry III [3:0:3]
In this course, students will study statistical mechanics that connects thermodynamics and quantum mechanics, reaction kinetics that deals with the speed of reaction, and molecular reaction dynamics that examines the formation and decomposition of chemical bonds at the molecular level. Also, the course will briefly cover the applied areas such as solid state physics and surface physics.

CH4221 Computational Chemistry [3:0:3]
The course will enable students to understand quantum chemistry methods in many-electron systems and apply computational chemistry in various research areas in chemistry such as molecular structure and reaction, molecular spectroscopy and spectrum analyses.

CH4222 Energy Conversion and Storage [3:0:3]
In the course, students will acquire a theoretical foundation on mutual conversion between electrical energy and other various forms of energy, and characteristic conversion between homogenous energies. In addition, students will study the materials, devices and systems for efficient conversion and storage of energy.

CH4223 Bioanalytical Chemistry [3:0:3]
This course will deal with various forms of optics that analyzes cells, genes, protein and metabolites, chromatography, electrophoresis, single-electron analyses, nanotools, etc., and also introduce the latest immunochemical analyses, molecular diagnoses, biosensors and Bioanalytical Chemistry's applications of the bioindustry.

CH9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

CH9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

CH9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

4. Life Sciences

A. Overview of concentration

The Life Sciences concentration aims to provide students who select this concentration the basic knowledge and the latest information in various fields of biology. To accomplish this, this concentration encompasses a wide spectrum of subjects, from fundamental courses of biology to more specialized concentration courses. Through three required concentration courses, students will obtain fundamental knowledge on different aspects of life phenomena and, through two required experiment courses, they will learn the latest theories and experimental techniques to solve the various secrets of the phenomena of life. In consideration of the diverse areas of interest of students who select this concentration, a flexible selection of courses are readily available after the completion of the required concentration courses. Students will be able to gain intensive education in specific areas through their enrollment in graduate-level courses and individual research in relevant graduate school labs. Graduates completing this concentrat ion curriculum are expected to possess the knowledge and experience needed in selecting successful career paths in Life Sciences and other related fields.

B. Overview of courses

BS2101 Organic Chemistry Ⅰ [3:0:3]

This course introduces the fundamental concepts of chemistry to gain understanding of organic molecules, which are a constituent substance of living organisms and are closely related to our lives. An important purpose of this course is for students to learn the relationship between the structure and reactivity of organic molecules. Other topics dealt with in the course include chemical bonds, nomenclature, isomers, stereochemistry, functional groups, spectrometry, and synthesis and reaction mechanisms. After completing this course, students will have obtained basic concepts in understanding the structure, properties, reactivity, etc. of molecules and substances that they will encounter in other subjects.

BS2102 Molecular Biology [3:0:3]

What is a gene and how does it function? Also, how has research on genes progressed? Genes consist of DNA and, according to the “central dogma,” genetic information is delivered from DNA to RNA and then to protein. This course studies the definition of genes, cases of genetic research, and gene expression in prokaryotic cells and eukaryotic cells. The objective of the course is for students to understand Molecular Biology at the level of DNA, RNA and protein as well as to pursue their in-depth comprehension of genes as a whole by learning about the structure and functions of genes from a genetics standpoint.

BS3101 Biochemistry II [3:0:3]

Biochemistry is a course in which students learn all about the chemical phenomena that take place in a living organism. The course will be taught in two courses, I and II, and the primary textbook of the course is [*Biochemistry (5e)* by Garrett & Grisham]. In Biochemistry II, more intensive chemical principles of life phenomena will be introduced based on the fundamental knowledge learned in Biochemistry I. The course will deal with the creation and storage of bioenergy, biosynthesis, and control during decomposition with a focus on bioenergy metabolism that takes place in cells. Subtopics include 1) understanding the concept of biometabolism, 2) biosynthesis and storage of sugar, 3) biosynthesis and biodegradation of lipids and steroid, and 4) biosynthesis of amino acids and nucleic acids. Also, the course additionally studies protein folding, gene expression and replication and signal transmission to materialize relevant knowledge. This course will provide the basics needed for students to understand more intensive biology subjects including Molecular Biology, Cell Biology, Pharmacy, Medicinal Chemistry, Chemical Biology and Genetics.

BS3105 Cell Biology [3:0:3]
The basic unit of life is cells, which is why Cell Biology is the foundation for all studies related to biology and medicine today. In the first part of the course, students will learn about detailed structures and functions of various elements that form eukaryotic cells. Subtopics discussed in this section include the creation and heredity of cell organelles, endocytosis, exocytosis, membrane transport, protein mobilization, cell forms and creation of polarity, interactions among cells, etc. The latter part of the course will focus on cell growth, cytodifferentiation and apoptosis and also examine signal transmission and functions in cells, which are necessary for controlling cell growth (including somatic cell division and meiosis) and apoptosis. The balance between cell growth and apoptosis must be closely controlled to generate sound entities and the fact that any changes in such control may lead to abnormalities and, even, cancer is where the importance of this course lies. The course aims for students to acquire basic knowledge on the structure and functions of living cells and various experimental techniques for the subsequent investigation, and also examines major cases of research and experiments to understand the delicate balance between signal transmission and control action that are needed in life phenomena.

BS3111 Biochemistry & Molecular Biology Laboratory [1:4:3]
This course is designed to introduce various experiments and exercises in the field of molecular biology and biochemistry to its students to help them better understand the core mechanisms that are mutually related within a living body. Major topics include gene transcription and translation control, synthesis and control of proteins, movement in and out of cell membranes, formation and control of the cytoskeleton, cell division and signal transmission within cells. Students will encounter such topics in experiments through various molecular biology and biochemistry techniques as well as imaging techniques using microscopes.

BS3112 Cell & Developmental Biology Laboratory [1:4:3]
This course aims for students to experience various experiment techniques of cell biology and learn how to apply them. This course will deal with the confirmation of protein components of cell fraction and the cytoskeleton, observation of cell organells and the cytoskeleton by using microscopes and basic experiment techniques needed to cultivate human cells. Also, this course will allow students to write experiment reports equivalent to those of general scientific papers. Through this process, students who take this course will be able to first understand the fundamental principles and concepts of experimental techniques that cell biologists use and, secondly, understand papers in the field of cell biology and analyze the data while, third, write detailed and accurate experiment reports and acquire the ability to propose the experiment results in the form of scientific papers.

BS3113 Biochemistry Ⅰ [3:0:3]
Biochemistry is a course in which students learn all about the chemical phenomena that take place in a living organism. The course will be taught in two courses, I and II, and the primary textbookof the course is [*Biochemistry (5e)* by Garrett & Grisham]. Biochemistry I introduces the chemical structures and functions and physical characteristics of biomaterials that form a living thing. The course will briefly cover essential topics such as the properties of aqueous solutions and thermodynamic properties, and focus the discussion on biochemical functions and structures of amino acids, proteins, nucleic acids, carbohydrates and lipids, all of which are major components of living bodies, and their roles in cells. Also, the course includes lectures on the usage of fundamental bioinformatics, which is necessary for biochemistry research, including thesis search methods, DNA and protein sequence comparison method and protein structural analyses method. The objective of this course is to introduce the basic knowledge of biochemistry to students so that they can easily understand various experimental techniques that investigate this knowledge.

BS3201 Microbiology [3:0:3]
Microorganisms generally refer to living organisms made of single cells and, in a broad sense, include protists and fungi of eukaryotes, prokaryotes and viruses. In fact, microorganisms are small organisms that can be seen only through microscopes but serve an extremely important role in the organism environment. The course of Microbiology first focuses on understanding the characteristics that can define microorganisms and the principles of the classification system according to the characteristics. After learning about the general characteristics of microorganisms, the ultimate goal of the course is for students to understand the direct and indirect effect of microorganisms on the actual environment and unit living organisms.

BS3202 Genetics [3:0:3]
In this course, students learn the basic concepts of genetics and the applications of genetics are studied to understand complex life phenomena that take place at various levels such as molecular, cellular and multi-cellular. Major contents to be covered include the structure and functions of genes, chromosomes and dielectric substances, Mendelian inheritance, genetic mapping, molecular genetics, genetic variants, genetic clustering, functional analysis of protein utilizing techniques of genetics, gene expression analysis, and understanding of genetic diseases.

BS3204 Introduction to Biophysical Chemistry [3:0:3]
This course introduces students to the biophysical principles from a chemical standpoint in order to fundamentally understand the phenomena taking place in cells and at the molecular level. By theoretically approaching the topics of biology and physical chemistry, the course aims to have students understand their operating principles. For this, the course teaches the laws of thermodynamics, forces exerted among molecules, enzyme kinetics, interactions among molecules and the relationship between the structure and functions of biomolecules. Through this course, students will be able to understand the operating principles of the functions of life phenomena at the molecular level based on a theoretical background. Recommended prerequisites include Mathematics, General Biology, General Chemistry, Biochemistry or any equivalent subject.

BS3205 Environmental Ecology [3:0:3]
Ecology researches environmental factors that form today's natural ecosystem and, through this, predicts the effect of a changed environment of the future on the natural ecosystem. This course will deal with various factors working to form the ecosystem, and the interaction between non-biological environmental factors and biological species. In addition, the course will introduce students to various kinds of groups and ecosystems that exist today and discuss the energy, material decomposition and species diversity that such characteristics create.

BS4201 Developmental Biology [3:0:3]
Developmental Biology integrates the perspectives of entities, cells, genes and molecules regarding zoogony, and primarily focuses its lectures on the principles of cytodifferentiation, morphogenesis and growth as well as molecular mechanisms. Topics of the lectures include creation of eggs and sperm, fertilization, embryo division, gastrulation, initial occurrence of vertebrates and invertebrates, patterning, organogenesis and stem cells.

BS4202 Physiology [3:0:3]
Physiology is a subject that aims to have students understand the functions of living organisms through physical and chemical principles. Though it may be subdivided depending on the targets of the interests and the degree of analyses, this course aims for its students understand life phenomena taking place in cells, tissues, organs and systems of animals, especially humans. The course will also minimize any overlap with other courses and, for intensive learning, primarily deals with muscle physiology, circulation of the cardiovascular system, respiration and pulmonary circulation, gastrointestinal physiology, physiology of internal secretion and reproductive physiology. Through this course, students are expected to understand the operating principles of human body functions at the molecular and cellular level.

BS4204 Neurobiology [3:0:3]
The course introduces the overall basic concepts of the field of neurobiology and especially aims to help students understand today's Neurobiology regarding the operating principles of the nervous system at the cellular and molecular level. Topics of the lectures include the nervous system, neurotomy, electric properties of neurons, synaptic transmission, memories and learning, neurobiology, senses and movement system, control of behaviors and physiology of body, perception, etc.

BS4205 Immunology [3:0:3]
The immune system protects living organisms from external pathogenic factors (pathogenic organisms and substances), thus serving an extremely important role in protecting and maintaining entities. In this process, living organisms must recognize external pathogenic factors and there needs to be a mechanism that recognizes and protects against such factors. There are two types of systems involved in the defense mechanism: inherent immunity system and acquired immunity system, which only exist in vertebrates, and these two systems form an organic relationship in defending against pathogenic factors. This course of Immunology aims to have students understand the principles of differentiating pathogenic factors from non-pathogenic factors in the immune system and the organic relationship that leads from inherent immunity to acquired immunity.

BS4206 Medicinal Chemistry [3:0:3]
Medicinal Chemistry (or drug chemistry) is a subject in which students can acquire integrated knowledge for the development of new medicine. The course is based on the fundamental knowledge in prerequisite subjects such as Organic Chemistry and Biochemistry as well as physiological knowledge, and will deal with the logical outline on the principle of the promotion of new medicine development as well as individual topics on the actual development of various medicinal substances. Lectures will cover the following areas: (1) Relevance between diseases and biomolecules (target biomolecules for the development of new medicine), (2) strategies and principles for the discovery, design and optimization of candidate substances of new drugs, and (3) the operating mechanism of various medicinal substances and their detailed development process.

BS4207 Introductory Cancer Biology [3:0:3]
The processes of occurrence, metastasis, treatment, etc. of cancer are systematically analyzed at the molecular level. This course analyzes the genetic and molecular-biological mechanism of cancerization, systematically analyzes the molecular mechanism of metastasis of cancer, and explains the present and forecast of cancer treatments.

BS4211 Synthetic Biology [3:0:3]
This course introduces the methodologies and limitations of existing life sciences to students majoring in a life sciences program as well as those of other majors interested in life sciences. The course also presents the purpose and methodologies of synthetic biology, which is a new attempt to overcome such limitations. Moreover, the course allows students to obtain first-hand experience on the methodologies of synthetic biology by conducting simple mission projects utilizing experimental techniques of synthetic biology.

BS4212 Molecular Biology of Cancer [3:0:3]
This course enables students to understand the formation of cancer and the metastasis mechanism by the approach of histology, biochemistry, physiology, and molecular biology, thus aiming to cultivate their ability to apply the knowledge to research for the treatment of cancer.

BS4213 Medical Immunochemistry [3:0:3]
This course aims for students to understand the molecular characteristics of antigens and antibodies as well as the principles of antigen and antibody responses before studying cases in which they are applied to diagnose and treat diseases.

BS4214 Basic Structural Biology [3:0:3]
This course deals with the theoretical foundation of modern structural biology. In particular, the course aims for students to understand the operating mechanisms of various protein groups at the molecular level based on the structural information acquired using X-ray crystallography.

BS4215 Metabolic Reprogramming [3:0:3]
Tumor metabolic reprogramming aims to provide students with in-depth understanding of how cancer cells skillfully control and perform metabolic reprograming on metabolic process in order to survive in a living body and utilize the metabolic process for unlimited proliferation. For this, the course, with the latest research methodologies, technology and data analyses, ultimately looks to enable students to read and understand papers that have become key milestones in this field and acquire and understand the latest trends in research. In particular, the course explores, in various methods of biochemistry and molecular cytology, how cancer cells fabricate the metabolic process of normal cells at a minutely molecular level and, also, cleverly use the synthetic metabolic process of normal biomolecules in order to be supplied with an abundance of biomolecules such as energy, amino acids and nucleic acids, which are needed for unlimited proliferation.

BS4216 Proteins in Life Sciences [3:0:3]
This course examines the entire process of the creation, growth, change, movement and decomposition of proteins, which execute most of their functions in cells, and also contemplates on the quantitative and qualitative management mechanisms of proteins in cells as well as their correlation with human diseases.

BS9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

BS9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

BS9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

5. Electrical Engineering and Computer Science

A. Overview of concentration

Mankind lives in the revolutionary age of Information Technology (IT) thanks to the inventions of computers, the Internet and smartphones. IT has brought about a paradigm shift in communication by giving birth to social networks (SN) in which people, regardless of time and space sharing the same interests, can communicate intimately anywhere anytime, thus changing the appearance of human life. Due to the influence of IT, new economic and social ecosystems are being formed including the weakening of t raditional markets, the advent of cyber markets and the acceleration of the global market. The ability to quickly adapt to such changing environments and to create new social environments and markets can influence not only a company's rise and fall but also, may decide the future of an entire country.

Thus, to ensure the continuous growth of the information society, we must not only learn the basic principles of major technologies in the fields of electrical engineering, electronics engineering and computer science, which primarily deal with computers, but also the Internet and mobile phones that have enabled the IT revolution. We must also develop our students further to foster talents who are capable of performing R&D in technologies aimed at realizing a better life for people and responding well to the new challenges to come in the post-IT era.

The concentration of Electrical Engineering and Computer Science aims for students to gain expansive scientific knowledge, cultivate their abilities in meticulous analysis and creative design through various courses in the concentration. The concentration also fosters such students' ability to creatively solve problems by integrating a wide spectrum of knowledge and experience acquired in not only the field of electrical data processing but also in several related areas through individual and graduate research. Upon graduation, students will become capable of pioneering their own paths in the industries based on the skills they train and develop in the undergraduate program and, after successfully completing their studies in graduate school, they will be able to successfully seek career paths in academia as well.

In the Division of Liberal Arts and Sciences, students also take core fundamental subjects in the Electrical Engineering and Computer Science curriculum, which include Computer Programming, Introduction to Electrical Engineering and Computer Science, Object-oriented Programming, and Electromagnetism and Recitation I. By completing these courses, students can obtain the basic knowledge needed to study in the field of Electrical Engineering and Computer Science in the future. The fundamental subjects in Electrical Engineering and Computer Science not only help form a foundation in preparation for courses to be taken during sophomore through senior years as students of the concentration but also serve to extensively introduce those outside the concentrati on to key concepts in electrical engineering and computer science.

The concentration curriculum officially begins when sophmore and junior enroll in core subjects in Electrical Engineering and Computer Science. For the senior curriculum, a wider variety of concentration electives have been established to enable students to individually set up their career objectives and choose suitable courses accordingly to complete their tailored curriculum. The core curriculum of Electrical Engineering and Computer Science includes Digital Design, Electric Circuit Theory, Data Structure, Introduction to Algorithms, electromagnetism, semiconductors, computer systems and operating systems. Students may also take a host of different concentration electives in the three areas of Electrical Engineering and Computer Science: Circuits and Systems, Physical Electronics and Optical Engineering, and Computer Science and Engineering. Also, based on the experience of conducting research on their own in areas related to the concentration through electrical computing projects, G-SURF and graduate research, students cultivate their creativity, which in turn allows them to define and solve engineering problems by themselves.

The concentration of Electrical Engineering and Computer Science provides opportunities to both students in and outside the concentration to cultivate their basic knowledge in the field. The acquired knowledge from these courses can be applied to different concentrations.

B. Overview of courses

EC3101 Electronics Laboratory [1:4:3]
This experiment course is a lab course for electronic devices and circuits and aims for students to understand their operating principles through actual experiments on theories. In the first part of the course, students will gain insight into the operating principles of not only basic electronic devices such as diodes, BJT and MOSFET, which correspond to electronic devices and basic circuits, but also electronic devices and circuits by designing and realizing audio amplifiers that use them. In the latter part of the course, students will select topics of their own choosing on electronic circuits to carry out individual projects, thus cultivating their ability to execute research and solve problems that are needed in actual research and industries.

EC3102 Computer Systems Theory and Laboratory [2:4:4]
This is a course that guides students to gain a system-wide understanding of computer systems as a whole and to experience actual programming. The course seeks to have students understand various issues in computer systems in relation to operating systems and computer networking. Also, the course enables students to empirically experience hardware and software structures of various computer systems and also carry out exercises to allow free utilization of the computer systems. In order to empirically assess the comprehensive meaning of computers systems corresponding to cloud and big data provided by future-style ICT infrastructure, individual students will choose their own exercise topics and carry out exercises through which they independently establish and run computer systems.

EC2201 Electric Circuit Theory [3:0:3]
This course aims to educate students on basic grounding to facilitate their understanding of electrical engineering and computer science that comprise electrical and electronic circuits, electronics, realization of communication circuits and equivalent model for control systems as well as subsequently needed resistance, electric condensers, inductors, voltage source, current source and other abstracted devices. In the course, students will also design and become familiar with transient-state and steady-state analyses of electric circuits formed by such devices, frequency response analyses, diodes, transistors, and basic circuits utilizing operational amplifiers.

EC2202 Data Structure [3:0:3]
This course introduces the core basic principles of data structures and object-oriented programming. In the course, students will learn about advanced object-oriented programming techniques such as inheritance, abstract class and encapsulation as well as data structures including arrays, linked lists, stacks, queues, trees, maps and graphs. Correspondingly, they will study the fundamental concepts of software programming for the design and realization of algorithms like search trees and arrays as well as large-sized programs.

EC2203 Digital Design [3:0:3]
This is an introductory course on digital logic circuits that examines the essential basic principles and technologies needed to design and realize digital hardware systems, and particularly deals with the fundamental principles of the number system, logic gate, fixed point representation, Boolean function, Boolean algebra, combination and order logic circuits, flip-flop, register, and programmable logic elements. Also, the course introduces basic components for the realization of diverse digital functions and provides elementary knowledge that students need in order to take upper-level courses related to computer system design.

EC2204 Computer Architecture [3:0:3]
This course helps students understand the basic structure and principles of the operation and design of computers based on a set of commands. In particular, the course proceeds with a focus on the performance of computers and will look at the latest and most advanced technologies used in the enhancement of computer performance, including pipelining, cache memory and IO devices.

EC2205 Engineering Electromagnetics [3:0:3]
This course is based on the existing understanding of static electromagnetic fields and aims to have students grasp the basic characteristics of electromagnetic fields that change with time, particularly focusing on the engineering application of electromagnetic waves. Through the simplest plane waves, students will come to understand Maxwell's equations and the basic characteristics of electromagnetic waves. The course will also cover the delivery of signals and power on transmission lines as well as impedance matching. Moreover, students will learn about the role of optical waveguides and the concept of the formation of guided modes.

EC2206 Introduction to Algorithms [3:0:3]
This course introduces the essential principles of computation algorithms. In the course, students will learn about the concepts of graphs, divide and conquer, dynamic programming, greedy algorithm, backtracking, branch and bound, computational complexity, NP theory and Heuristic algorithms.

EC3202 Signals and Systems [3:0:3]
This course deals with the interpretation of invariant signals for continuous and discrete linearity and the basics of interactions between these signals and systems. For this, students will become familiarized with the concepts and methods of complex number frequency analyses including the Fourier series and transform, Laplace and Z-transform, impulse response, sampling, filtering, modulation and convolution.

EC3204 Programming Languages and Compilers [3:0:3]
This course aims to have students understand the operating principles of programming languages. Topics that will be dealt with in detail include the elements in language design (name, value, type, control flow and abstraction), realization technologies (syntax analysis, semantic analysis, interpretation, compiling and optimization) and design paradigms of major languages (order-oriented, object-oriented and function-oriented). Through class assignments, students will design programming languages and become aware of real-world problems that occur during the process of realization.

EC3206 Semiconductor Materials and Devices [3:0:3]
This course deals with physical mechanisms, which are needed to understand the electrical and optical characteristics of semiconductor materials and devices, based on the concepts of quantum mechanics and solid state physics. The course deals with undergraduate-level operating principles of electrical devices and also explains how to utilize them in the real world. Topics that will be dealt with in detail include operating principles encompassing a solid crystal structure, energy band theory, charge distribution and coupling, PN junction structure and optical devices as well as bipolar junction transistors and MOS field-effect transistors.

EC3207 Microelectronic Circuit [3:0:3]
This course is based on semiconductor devices and lectures on the single stage amplifier, cascode amplifier, differential amplifier and operational amplifier for the design of digital integrated circuits. Also, the course teaches students how to interpret and design frequency responses of integrated circuit amplifiers and their noise characteristics as well as the interpretation and design of feedback amplifiers. Moreover, the course examines nonlinear analyses of integrated circuits, which is extremely important for large-signal characteristics of amplifiers.

EC3212 Advanced Electronic Circuit [3:0:3]
This course reviews the basic motions of an MOS transistor and designs of the single stage amplifier, cascode amplifier, differential amplifier and operational amplifier while also analyzing circuit characteristics in frequency domains. Students will analyze frequency response characteristics in feedback circuits and learn about frequency compensation techniques for phase margin, nonlinearity and noise in transistor circuits and the circuit technique to reduce them. Also, students will look at stable voltage reference and current-generating circuits.

EC3214 Microprocessor and Application [2:2:3]
This course comprises of three parts. In the first part, students will learn about the basic structure of microprocessors (ARM processor), registers, memory, cache and input and output operations as well as how to operate processors using basic assembly languages. The second part will study how to use ARM-based microprocessors and processors through exercises. Lastly, students participating in the lectures will execute projects through the realization of embedded systems such as mobile robots based on ARM processors. The executed projects will be evaluated after public demonstrations around the midterms and final exams.

EC3215 System Programming [3:0:3]
This course studies software (system software) that helps in the development of other software. System software is a type of software that provides services to applied programs like compilers (system language, linker), operating systems, scientific calculation systems, game engines and industrial automation. System software is located between applied programs and hardware to connect the two. Through this course, students gain an understand of the situations taking place behind the stage of computers.

EC3216 Automata Theory [3:0:3]
This course introduces major theories and concepts such as formal language, automata, grammar and computational complexity, which form the basis throughout computer science. The major contents to be introduced include finite automata, regular language, context-free grammar, push-down automata, pumping lemma, Turing machine, Chomsky hierarchy, circular enumerable language, crystallinity and non-crystallinity, unsolvable problems, and computational complexity.

EC3218 Communication Engineering [3:0:3]
This course properly combines and introduces students to theoretical education and design training. The course enables students to understand major theories for the design of communication systems such as the signal transmission process through antennas, analog and digital modulation, AM and FM signals, signal detection, line code, broadband communication, cellular networks and multiple access method, and also design simple communication systems through MATLAB demo tests and software radio.

EC4202 Digital Integrated Circuit [3:0:3]
This course aims to have students obtain the fundamental knowledge needed to design and analyze digital integrated circuits using the CMOS process. Students will learn how to design and analyze basic circuits that constitute the majority of today's digital integrated circuits, including combinational and sequential logic circuits, dynamic logic circuits and semiconductor memory circuits. In addition, topics such as process changes, components of various parasitic circuits and delayed deliveries, all of which need to be considered when constituting actual integrated circuits, will be discussed in detail.

EC4203 Microwave Engineering [3:0:3]
Microwave and RF technology, circuit network analysis and synthesis form the basis for the understanding of wireless communications systems and microwave circuits. This course will begin by inducing the microwave transmission line theory from Maxwell's equations and study wave characteristics including the generation of electromagnetic waves, free space and waveguides. Students will design and analyze impedance transformers using lumped constant circuits and distributed circuits as well as filters, power dividers and combiners and also gain understanding of microwave circuit design methodologies using the Smith chart and S-parameter while executing design exercises utilizing computer design tools.

EC4204 Database Systems [3:0:3]
This course deals with the fundamental concepts that constitute a database and topics related to its realization. The course will cover a wide range of topics including database structures, conceptual data modeling, database query language, relational database, object-oriented database, transactions, concurrency control and recovery.

EC4205 Operating Systems [3:0:3]
This course deals with the concepts and design of operating systems used in common computers. Major topics include processes, threads, process scheduling, process synchronization, multi-processing, deadlock avoidance, file systems, memory management and security. Important concepts will be explained by using actual examples used in a variety of operating systems and the course focuses on increasing the understanding of the correlation among these concepts.

EC4206 Computer Networking [3:0:3]
The course aims for students to understand the basics of computer-based data communications and the latest technological growth. The course covers various technologies on network protocol and structure and such technologies include the principles of IP-based network structures, transport protocols, Internet routing basics, router design, network source management, network safety and P-to-P networks.

EC4207 Graph Theory [3:0:3]
Graph Theory is a subject that forms the theoretical basis of computer science. This course introduces the concepts and known results that form the foundation of Graph Theory and teaches its applications. Through the systematic learning of Graph Theory, students develop mathematical thinking.

EC4208 Networked Robot Lab [1:4:3]

- Programming techniques for the control of external devices
- Location estimation technique
- Tracking and feedback technology
- Wireless networking
- Theory on modeling and remote robot control
- Scheduling technique

EC4209 Artificial Intelligence [3:0:3]
This course introduces the basic concepts in search and knowledge representation as well as to a number of sub-areas of artificial intelligence. The course focuses on covering the essential concepts in AI and covers intelligent agents; uninformed/blind search: breadth-first search, uniform-cost search, depth-first search, depth-limited search, iterative deepening search; informed/heuristic search: greedy best-first search, A* algorithm; local search: hill climbing and simulated annealing; adversarial search: minimax algorithm and alpha-beta pruning; constraint satisfaction problems: backtracking search, constraint propagation, local search; logical agents: propositional logic, first-order logic, logical inference; uncertainty: Bayes' rule, Bayesian inference, independence and conditional independence, Bayesian networks; fuzzy logic; neural networks; and machine learning: decision tree learning, naive Bayes classifier.

EC4210 Random Process [3:0:3]
This course aims at providing students with the fundamental concepts of random processes for electrical engineering and computer science. Topics include probability and random variables; random processes and sequences; response of linear systems to random inputs; correlation; power spectral density; and specific random processes such as the Wiener process, Poisson process, and Markov process. Students are expected to be able to apply the fundamental concepts of random processes to problems related to communication, signal processing, and networking research areas, upon completion of this course.

EC4211 Digital Signal Processing [3:0:3]
In this course, students study the fundamentals of discrete-time signals, systems, modern digital processing algorithms & applications. The main topics to be covered in this course are: Discrete-Time Signals and Systems, Frequency Analysis of Signals and Systems, The Z-Transform, DFT and FFT, Digital Filter Design, Sampling and Reconstruction of Signals, and Multi-Rate Digital Signal Processing.

EC4212 Discrete Mathematics [3:0:3]
This course studies targets that retain differentiated values such as integers, graphs and logical operations instead of those with continuous properties like real numbers. Specifically, the course will deal with contents on logical structure, proofs, number theory, graphs, tree structures and discrete probability.

EC4213 Machine Learning and Deep Learning [3:0:3]
The main focus areas of this course are fundamental machine learning theories including Bayesian, artificial neural networks, support vector machines, and several clustering algorithms. Applications to speech recognition, facial recognition, biomedical data mining, and image segmentation/classification will also be considered to for the term projects.

EC4214 Introduction to Photonics [3:0:3]
This course introduces students to the current technology and basic concepts of photonics related to the usage and utilization of light and, in doing so, the following four topics are discussed: 1. characteristics of light, 2. occurrence of light, 3. detection of light, and 4. application of light. The scope of lectures also include the classical as well as quantum characteristics of light.

EC4215 Computer Graphics [3:0:3]
This course will introduce and discuss 2D and 3D graphics, rasterization, representation of curve/surface/solid, shading, and graphics hardware.

EC4217 Digital Communication Systems [3:0:3]
This course discusses the basic principles of digital communication systems. Main topics to be covered are source coding, digital modulation, detection, and equalization. Error correcting codes will also be discussed briefly.

EC4301 Special Topics on Basic Electrical Engineering and Computer Science [3:0:3]
The Fourth Industrial Revolution is a revolution of the future that is still to come. Intelligent information innovation technology such as AI, robots and blockchain is expected to end the industrial society and propel an intelligent information society. A great way to prepare for the future is to set a proper direction and subsequently create good technologies. This course introduces new technologies leading the Fourth Industrial Revolution.

EC9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

EC9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

EC9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

6. Mechanical Engineering

A. Overview of concentration

Having grown exponentially since the industrial revolution and providing the base technology for the realization of modern civilized societies, Mechanical Engineering is a foundational field required to materialize products in pursuit of the convenience, safety and happiness of human lives over a wide spectrum of areas including automobiles, aircraft, robots, ships, high-speed trains, ultra-precision machines, home appliances, data input and output machines, medical devices, MEMS, subminiature sensors, biosensors, health training and physical therapy equipment, agricultural machines, textile machines, solar power generation, wind power generation, fuel cells, and spacecraft. In future society as well, it is a field that will greatly contribute to the realization of original research, facilities, machines, devices, elements and materials through collaboration with other professional domains such as electronics, shipbuilding, aviation, architecture, chemical industry, medical field, life sciences, culture and arts, humanities and social sciences. The curriculum is composed topics including dynamics and vibration, which deals with the structural changes and movements by forces exerted both inside and outside of devices; heat transfer and fluid mechanics, which examines the flow of heat and fluids; design and virtual simulation based on modeling, control and measurements for system control; and creative design manufacturing projects, and this focuses on the development of students' comprehensive engineering design capacity to solve real-world problems in various areas.

B. Overview of courses

MC2100 Thermodynamics [3:0:3]

Thermodynamics is a subject that deals with the interconversion of heat, work and energy and, in this course, the basic concepts of thermodynamics are introduced in addition to applications of the fundamental concepts through notable heat engines such as gas turbines, steam engines and cooling engines.

MC2101 Solid Mechanics [3:0:3]

This course covers the fundamental concepts of stress-strain, deformation, elasticity, deformation energy and deflection of beams as well as tension, compression, distortion and bending of basic mechanical structures. By examining topics on the forces exerted on mechanical structures and subsequent deformations, the course will be meaningfully for students to utilize the acquired knowledge in the analysis and design of mechanical structures.

MC3103 Kinematics and Dynamics [2:2:3]

Kinematics and Dynamics is a study that can answer such questions as how the motion of all moving objects (displacement, velocity, acceleration) is expressed and how an object will react once an external force is exerted on it. Once the fundamental principles of dynamics are understood, students will be able to comprehend the motions of automobiles, airplanes, humans and animals and, based on this, a system may be designed and controlled. This course explains the basic principles of dynamics in particles and rigid bodies and also examines the relationship among work, energy, impact and momentum. The fundamental principles can be experienced through various experiments and simulations.

MC3105 Fluid Mechanics [3:1:3]

This course covers the basic concepts of fluid mechanics and how to apply it to notable flow systems. Major topics include characteristics of fluids, basic mechanics of flow, governing equation of flow, dimensional analysis and similarity and viscous fluids.

MC3201 Heat Transfer [2:2:3]

This course introduces students to the three modes of heat transfer: convection, conduction and radiation. In convection, heat transfer is performed by the arbitrary movement of fluid molecules or lattice vibration and the movement of electrons in a solid. In conduction, heat transfer is carried out along with the transport of a substance by group movement rather than the arbitrary movement of individual fluid molecules.
Unlike convection or conduction, in radiation, electromagnetic waves directly deliver heat energy and, thus, it does not require a medium. The knowledge of heat transfer is being applied to various mechanical systems such as automotive engines, air conditioners and satellites.

MC3202 Vibration [2:2:3]

This course provides the fundamental background of vibration phenomena. Students will become familiar with topics ranging from single DOF to multi DOF and theory as well as numerical and experimental methods. The course covers the Lagrange equation, Laplace transformation, Fourier transformation, mode superposition, finite element method, and experimental modal analysis. This course also introduces the basic concepts of sound, acoustic wave, impedance, sound pressure level (SPL), acoustic wave equation, sound transmission and reflection, mass law, and acoustic devices such as the Helmholtz resonator and muffler. Due to the limitation of class time, only general concepts are covered in this class.

MC3203 Electromechnical System Modeling [3:0:3]

In this course, students learn about the modeling technique using bond graphs in order to understand mathematically explained system dynamics from the standpoint of interconversion of energy or power. The universal modeling technique, which enables understanding of various physical systems including mechanical, hydraulic, electrical, electronic and magnetic systems via a single graphic modeling technique, will be introduced. Through this, students will be asked to understand not only the method of inducing dynamic relationships of a system but also design stability and instability. The primary objective of the course is to raise the level of intuition for the mathematical and physical understanding of actuators, sensors and plants using the principle of electromagnetism, which is the most popularly utilized in mechatronics.

MC3204 Engineering Analysis [3:0:3]
This course introduces the basic tools and methods of numerical analysis, which is frequently used in science and engineering, and it includes the C programming language, Python for computer programming and Matlab for various simulations. Also, students will learn how to obtain the solution of a single-variable equation, perform numerical differentiation and integration, and find solutions of ODEs, linear systems and PDEs. Through exercise problems, students are expected to understand theories and methods through which motivation will be given for them to solve more difficult problems.

MC3205 Microprocessor & Applications [2:2:3]
This course comprises of three parts. In the first part, students will learn about the basic structure of microprocessors (ARM processor), registers, memory, cache and input and output operations as well as how to operate processors using basic assembly languages. The second part will study how to use ARM-based microprocessors and processors through exercises. Lastly, students participating in the lectures will execute projects through the realization of embedded systems such as mobile robots based on ARM processors. The executed projects will be evaluated after public demonstrations around the midterms and final exams.

MC3206 Materials Science and Engineering [3:0:3]
This course aims for students to obtain the basic theories of materials as a whole and a wide range of knowledge of the structure, characteristics and applications of materials. By studying the structures and characteristics of various materials, students will have the opportunity to build a foundation to understand the crystal structures of materials, faults in solids and their propagation, and phase equilibrium. Furthermore, the course is designed for students to understand electrical, thermal, magnetic and optical properties of materials to cultivate their ability to manufacture new materials and apply them to other areas.

MC3207 Signals and Systems [3:0:3]
This course deals with the interpretation of invariant signals for continuous and discrete linearity and the basics of interactions between these signals and systems. For this, students will become familiarized with the concepts and methods of complex number frequency analyses including the Fourier series and transform, Laplace and Z-transform, impulse response, sampling, filtering, modulation and convolution.

MC3208 Engineering Design [2:3:3]
This course provides students with knowledge in the systematic method of engineering design covering major design procedures from conceptual design to product design. Some detailed design techniques covered in the course includes generation of conceptual ideas, detailed concept development & evaluation, and product generation with realization. Students will experience the integration of mechanical engineering knowledges, design methods and product design processes.

MC3209 Creativity and Imagineering [3:0:3]
The course deals with creativity, creative problem (CP) finding and solving, and problem solving (PS) procedures combined with C efforts systematically. CPS integrates CP recognition, CP definition and analysis, and synthesis. C methods for C idea generation individually or by group are introduced.

MC3211 Computer Aided Design and Manufacturing [2:2:3]
This course teaches students fundamental mathematical theories, which constitute software that can design machines on a computer screen, and how to utilize them. The first part of the course will cover basic mathematics of geometric modeling in order to create part shapes as well as subsequent shape design of parts while practicing the theoretical knowledge with commercial CAD software. In the latter part of the course, students will use computers to learn about automatic tool path creation technology, which is needed to automatically process curves and shapes, and the actual production methods by the operation of machines.

MC4202 Finite Element Method [2:2:3]
This course introduces the basic concepts of Finite Element Method (FEM). Students will use stiffness methods to induce equations of truss and beam, linearly deformed trigonometric equation and 2D axisymmetric element equation, and also use eyewear tools to solve simple engineering problems and conduct exercises on FEM theory.

MC4204 Robotics [2:2:3]
This course introduces the overall theories needed in robotics as well as technologies such as actuators, design, sensors, dynamics, control, AI and navigation. With a goal to provide students with a general view on robotics, the course looks at robot mechanisms and also related assistive technology (for example, sensing and actuators for robots and robot intelligence utilizing AI, etc.). The course primarily utilizes ROS (robot OS), a software framework for robot development, and also allows students to develop various applications that use 6-axis robot arms.

MC4205 Principle of Precision Design [3:0:3]
All machines are made through the comprehensive design of various physical phenomena including mechanics of materials, dynamics, vibration, control, measurement sensing and, even, heat transfer. Large machines aim to achieve ultra-precision location control down to the submicron level in order to manufacture precision parts like engine cylinders, crank shafts, camera lenses and semiconductors. By teaching students the basic design and controlled variable measurement principle as well as technical topics that often appear when designing machines in the aforementioned field of machine manufacturing, this course enables students to cultivate a design foundation needed to develop experimental devices and actual machines.

MC4206 Principles of MEMS/NEMS (Micro/Nano Electro Mechanical Systems) [3:0:3]
MEMS (Micro Electro Mechanical Systems) is one of the key technologies for man-machine interface in the information society of the 21st\ century. This course will deal with MEMS material, micro/nano fabrication process, electromechanical principles & applications as shown below.
- Introduction to MEMS and materials properties
- Microfabrication technologies and its principles
- Micromechanics and scaling effects
- Applications of micro sensor & actuator for IoT and mobile devices

MC4208 Graphical System Design Programming [2:2:3]
In a variety of research areas including mechanical engineering, cultivating the ability to secure, analyze and control quality data is essential for talented students including undergraduate mechanical engineering students to gain qualifications as advanced researchers. This course enables students to acquire the aforementioned ability through LabVIEW and apply it to real-world research and industrial sites.

MC4209 Advanced Fluid Mechanics [3:1:3]
Advanced Fluid Mechanics is a graduate school-level Fluid Mechanics course. Lecture topics include flow shape, Navier-Stokes equations as the governing equation, introduction of compressible flow, fluid flow function, fluid velocity potential, vorticity dynamics, changes of other flows due to the Reynolds number, the exact solution of Navier-Stokes in a simple flow, turbulent flow transition, and turbulent flows.

MC4210 Computational Fluid Dynamics [3:0:3]
This course considers the two aspects, academic topics and research tools, of Computational Fluid Mechanics to comprehensively investigate the theories and applications of the latest Computational Fluid Mechanics. In the theory section, students learn the most advanced techniques dealing with the hyperbolic system of equations based on compressible fluid mechanics and, in the application section, students become familiar with the fundamentals of an open source library known as OpenFOAM as well as its utilization.

MC4211 Advanced Heat Transfer [3:0:3]
This course is designed to introduce advanced topics of heat transfer to graduate students, who have already taken an undergraduate heat transfer course. Among three different heat transfer modes, this course mainly focuses on heat conduction and thermal radiation.

MC4212 Optimal Design [3:0:3]
This course covers problem formulation and concepts of optimum design, mathematical programming including linear and nonlinear; design sensitivity analysis; trade off analysis; and recent research topics in design optimization.

MC4213 Advanced Solid Mechanics [3:0:3]
This course is composed of two parts. The first part aims to expand students' knowledge on introductory solid mechanics. Specifically, this part covers material behaviors, energy methods, and unsymmetrical bending. The second part focuses on the fundamental and unifying concept of continuum mechanics to facilitate further study of solid mechanics. Topics include stress tensor, kinematics of deformation, fundamental conservation laws and constitutive equations.

MC4214 Special Topics on Fluid Dynamics - Stability and Compressible Flow [3:0:3]
This course is a graduate-level course in fluid dynamics. Two topics will be covered in the course: hydrodynamic stability and compressible flow. The principal purpose of hydrodynamic stability is to present fundamental theories of stability that have wide application in engineering sciences, physics, and applied mathematics. Special focus will be placed on laminar-to-turbulent transition in boundary-layer flow. The area of compressible flow covers fluid phenomena with significant changes in fluid density. Compressible flow is relevant to high-speed aircraft, jet engines, gas pipelines, and many other fields. Fundamentals of compressible fluid dynamics and application to external and internal flows will be addressed. Concepts of aeroacoustics will also be included.

MC4215 Mechatronics System Signal Analysis and Circuit Design [3:0:3]
This course covers mechatronics system signal analysis and circuit design. The course includes concepts on circuit and energy, semiconductor devices, digital logic, time-frequency analysis, robots and electromagnetic sensors.

MC4216 Automatic Control [3:0:3]
Automatic Control is the first subject to take among the control theory courses, and primarily deals with the analysis and design of the continuous-time control system. Lectures will especially examine the Laplace transform, modeling of systems, analyses of initial and stable responses, the root-locus analysis and subsequent control system design, frequency response analysis and subsequent control system design. Through this course, students will learn simple but useful methods to design dynamic system controllers such as autonomous driving vehicles, unmanned aircraft and robots.

MC4217 Antenna Engineering [3:0:3]
This course teaches students the basic radiation theory, types and operating mechanisms of antennas, numerical analysis and antenna design.

MC4218 Introduction to Radar Systems [3:0:3]
This course aims to have students understand the fundamental principles of radar based on the radar equation, and lectures on the distance in radar equations, cross-sectional area of radars and antennas as well as radar signal processing including MTI, Doppler signal processing and detection.

MC4219 Advanced Thermodynamics [3:0:3]
This course studies how thermodynamics is actually used and raises the understanding of various principles of thermodynamics through diverse and detailed examples. By investigating exergy, psychrometric analysis, and chemical and phase equilibriums, which have not been dealt with in basic thermodynamics, students will be able to gain understanding in the principles and methods of their applications in real life.

MC9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

MC9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate theses, which needs to pass the thesis screening.

MC9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate theses, which needs to pass the thesis screening.

MC9104 Capstone Design II [1:6:3]
This course may replace Undergraduate Thesis Research II for students in the mechanical engineering major, and covers the following contents.
- Concept of graphics-based programming
- Data: Concepts and kinds of data types
- Source code debugging: Program debugging technique
- Structure: Programming structure (repetitive statement, branch statement)
- Modularization programming: Reusability enhancement technique of recurrent utilization code
- File input and output: Method of saving and reading collected and processed data
- Front panel control: UI design and user convenience enhancement technique
- Expansion of data flow: Concepts of queue and event, which are the base knowledge for design pattern learning
- Design pattern: Concepts and types of design patterns to proceed with large-scale projects
- Application making: Program build and distribution
- Measuring device control technique: G"PIB, RS-232, DAQ
- Implementation of single-topic project per person

7. Materials Science and Engineering

A. Overview of concentration

Materials Science and Engineering offers engineering education enabling students to obtain the scientific knowledge needed to understand various materials and discover new phenomena, and also develop and apply materials and elements that form the basis of future industries. In particular, unlike metal and ceramic-oriented studies contained in materials science and engineering curricula at other institutions, this concentration offers education in optical and semiconductor materials, nanoelectronic materials, organic information materials, energy materials, biomedical materials and other topics in the area of high added-value materials, thus enabling students to cultivate creative ability in producing new-breed materials for the enhancement of the welfare of the country and mankind.

The field of Optical and Semiconductor Materials provides basic knowledge in solid electronic devices and materials technology that are being industrially applied to semiconductor-based LED, silicon memory devices, and logic semiconductor devices, as well as expertise related to next-generation optical and semiconductor technologies such as new light source devices of the future; FET, the advanced concept of tunnels that aims to replace silicon devices; and graphene devices.

The field of Nanoelectronic Materials conducts research based on the understanding of the phenomena occurring at the nano scale and with a goal to develop materials and devices utilizing nano size characteristics. From the research of dynamic phenomena manifested in

low-dimension nanostructures and manufacturing of thin oxide films to the development of spintronic devices based on multi-layered magnetic thin films and high-efficiency devices based on fine nano-patterning, the field offers creative research directions that go beyond present nanotechnology in preparation for a post-nano age.

The field of Organic Information Materials designs and synthesizes new organic matters needed in areas related to NT (Nano Technology) and IT (Information Technology) and offers a platform from the standpoint of materials. Also, this field utilizes its platform and provides base knowledge for the applied development of knowledge through devices like light-emitting diodes, transistors, memory devices and sensor systems.

The field of Energy Materials offers fundamental knowledge in its Introduction to Materials Science and Engineering course for physical and chemical understanding. This course also includes applications of organic and inorganic materials related to energy in order to solve the challenges faced by the materials industry, including efficient conversion, storage and transport of energy, development and use of eco-friendly energy sources and development of new and renewable energy.

The field of Biomedical Materials is based on nanotechnology and biotechnology and offers biological base knowledge on the characteristics of organic and inorganic materials for the development of materials demanded by regenerative medicine, such as for drug delivery, medical images, neogenesis and the use of stem cells.

B. Overview of courses

MA2101 Introduction to Materials Science and Engineering [3:0:3]

This course aims for students to obtain the basic theories of materials as a whole and a wide range of knowledge of the structure, characteristics and applications of materials. By studying the structures and characteristics of various materials, students will have the opportunity to build a foundation to understand the crystal structures of materials, faults in solids and their propagation, and phase equilibrium. Furthermore, the course seeks for students to understand electrical, thermal, magnetic and optical properties of materials to cultivate their ability to manufacture new materials and apply them to other areas.

MA2102 Thermodynamics [3:0:3]

This course primarily teaches students the fundamental concepts of the three laws of thermodynamics. Also, the course introduces the concept of Gibbs free energy and, based on this, examines the meaning and figure of phase equilibrium. Then, the course looks into basic statistical thermodynamics and investigates the relationship with classical thermodynamics with the partition function as a medium.

MA2103 Organic Materials Chemistry [3:0:3]

This is the lecture course of Organic Chemistry II, which is for students who major in Materials Science and Engineering, that intensively covers the relationship between the structure and reactivity of organic materials based on the basic concepts learned in Organic Chemistry I. The course examines the characteristics and reactivity of various functional groups that constitute organic molecules as well as the conversion reaction among functional groups through which students can gain fundamental knowledge of synthesizing various organic materials and substances such as organic compounds, polymers and biomolecules.

MA2104 Introduction to Polymer Science [3:0:3]
Polymers influence a wide spectrum of science and engineering from plastic containers to BT, IT and NT. The objective of this course is for students to understand fundamental polymer science and technology including polymer synthesis, thermodynamic behavior in the state of solution and solid, elasticity of rubber, and application of separation membrane and electronic devices.

MA3104 Electronic Materials Laboratory [1:4:3]
This experiment course provides contents on fundamental experimental techniques and data analyses, which is required in various research areas of introductory materials science and engineering. Undergraduate students who enroll in this experiment course will learn and perform experiments on thin material film synthesis, synthesis of semiconductor and energy electrode materials, and characteristic analyses of physical chemistry.

MA3105 Organic Materials Laboratory [1:4:3]
This experiment course provides contents on fundamental experimental techniques and data analyses, which is required in various research areas of introductory materials science and engineering. Undergraduate students who enroll in this experiment course will learn about the synthesis of polymer organic materials and perform experiments on the characteristic analyses and application of physical chemistry in biomaterials and photoelectric materials.

MA2201 Physical Chemistry of Materials [3:0:3]
This course aims to establish the fundamental knowledge of physical chemistry needed for students to understand the properties of substances in Introduction to Materials Science and Engineering based on the integrated concept connecting macroscopic thermodynamics and microscopic quantum chemistry. The course will comprehensively cover topics such as the overview of the basic concepts of thermodynamics and quantum chemistry, statistical thermodynamics, reaction kinetics, reaction dynamics, gravitation among molecules, polymers and solids, surface and catalyst chemistry.

MA2202 Modern Material Physics [3:0:3]
This course aims to establish the basic concepts for the understanding of the behavior of electrons and the electrophysical nature of materials as well as to introduce students to related intensive areas. The course provides an overview of the particle properties of waves and wave properties of particles, which is the fundamental principle of electronic materials, as well as quantum mechanics, atomic model, solid state, crystal structure, band theory and semiconductors.

MA3203 Crystal Structure of Materials [3:0:3]
The physical, mechanical, chemical, electromagnetic and optical properties of materials are determined by the types of atoms that constitute these materials and their arrangements, which is known as the crystal structure. This is why the knowledge and understanding of crystal structures are required when developing new materials or investigating and comprehending material properties. Thus, through this course, students will study the crystal structures of materials based on crystallographic knowledge and also gain understanding of materials' crystal structures, correlation among various properties and, furthermore, the principles of X-ray diffraction.

MA3204 Phase Transformation [3:0:3]
Phase Transformation covers the basic theories of material-related thermodynamics, diagrams, propagation, crystal interfaces, microstructure, nucleation and growth. Based on the theories, the course ultimately aims for students to manufacture the structure of a desired material and control its thermodynamic and kinematic status.

MA3207 Materials Electrochemistry [3:0:3]
This course aims for students to learn basic principles and gain knowledge of electrochemistry while understanding the material characteristics and principles of electrodes and electrolytes. The course also seeks to have students understand electrochemical systems as applications and think about the materials utilized.

MA3208 Biomaterials [3:0:3]
This course aims for undergraduate students in the field of Materials Science and Engineering to gain fundamental knowledge in biomaterials and their applications. For the first seven weeks of the course, students will learn about the basic elements and roles of biomaterials as well as their interactions with biosystems and, for the following three weeks, they will examine various biomaterials and their characteristics. For the remaining period, the course will focus on biomaterial-based applications.

MA3209 Introduction to Mechanics of Materials [3:0:3]
This course will examine how the relationship between stress and strain and the macroscopic mechanical characteristics are related to a material's structure and microstructure, at the atomic, molecular and continuum levels. Through this course, students will learn about elastic and inelastic deformation and defects, fatigue and the grinding phenomena of metals, ceramic, polymers and complexes and also study the design and processing of materials for the acquisition of desired mechanical characteristics.

MA3210 Polymer Chemistry [3:0:3]
This introductory course on polymer chemistry and technology is for students in the fields of Introduction to Materials Science and Engineering, chemistry and chemical engineering equipped with fundamental knowledge in general sciences, and primarily deals with the types, synthesis, reformation and characteristics of polymers.

MA4202 Thin Film Technology [3:0:3]
This course introduces students to various physical and chemical methods for the creation and measurement of vacuum, operation of vacuum systems, and growth and etching of thin films, and also explains the related mechanisms in atomic theory and kinematics. For the growth and etching process of thin films, evaporation and deposition, sputtering, ion beam process, chemical vapor deposition, various plasma processes and monitoring technology will be introduced in addition to methods used to analyze the electrical, optical, chemical and structural characteristics of thin films and their surfaces. This course of Thin Film Technology aims to cover vacuum technology, characteristics and creation of plasma, growth and etching of thin films, process monitoring and related mechanisms in atomic theory, physical properties of thin films, and characteristics and applications of thin films.

MA4203 Introduction to Semiconductor Devices and Processes [3:0:3]
As they are being utilized in a variety of optical and electronic devices that form the basis of information industries, semiconductors are an essential material that has been furthered researched than any other materials. This course aims for students to learn the fundamental concepts of the basic properties of semiconductors, device manufacturing process and devices (PN junction, contact, MOSFET).

MA4204 Physical Properties of Polymer [3:0:3]
The physical properties of polymers are closely related to their molecular weights, glass transition temperatures and viscoelasticity and, based on these, polymers show significantly different characteristics compared to metals or ceramic materials. Thus, in this course, students will think about their correlation and raise the level of their understanding based on the physical chemistry characteristics of polymers while learning how to measure their physical properties.

MA4205 Polymer Synthesis [3:0:3]
This is a course for juniors and seniors and aims to have them understand various ways of polymerization including chain reaction polymerization and step reaction polymerization as well as the differences of reaction kinetics and reaction mechanism in a polymerization reaction. Simultaneously, the course will introduce various kinds of polymers and investigate their methods of polymerization.

MA4207 Biomedical Polymers [3:0:3]
This course introduces students to various polymers that have been used for medical purposes and the examples of their application. The course examines polymer substances based on different criteria, including synthetic and natural polymers, hydrolysis and zymolysis, and solid, hydrogel and nanosystems.

MA4208 Electronic Properties of Materials [3:0:3]
The basic properties of a material such as metal and semiconductors are determined by the properties of electrons that exist inside the object. This course will look at how electrons behave in the special structures of materials and, also, how their electrical, magnetic, optical and thermal properties displayed as a result are described.

MA4209 Materials for Nanobiotechnology [3:0:3]
Nanomaterials and biomaterials are extremely important materials that have shown remarkable achievements in the fields of renewable energy and health around the globe. In particular, manufacturing of renewable energy and fuel by catalysts and the treatment of diseases through the delivery of drugs are essential parts of nanobiotechnology. Thus, this course focuses on nano-biocatalyst conversion and nanomedicine and, subsequently, will deal with catalysts, biocatalysts, nano-biocatalysts, nano-sized imaging materials and nano-sized drug delivery substances.

MA4211 Materials for Plastic Electronics [3:0:3]
Plastic Electronics that use plastic electronic materials is a research area that can materialize low-priced, lightweight flexible electronic devices. Thus, the development of high-quality plastic electronic materials is extremely important in terms of the performance of devices. This course will examine various electronic devices and relevant electronic materials that are being researched in the field of plastic electronics.

MA4212 Introduction to Computational Materials Science [3:0:3]
This is an undergraduate-level course on the fundamentals of the introduction to computational materials science. Major contents of the lectures include numerical differentiation and integration, numerical solutions of differential equations, linear algebra, molecular dynamics and the Monte Carlo methods.

MA4213 Elements of Quantum Mechanics [3:0:3]
This course seeks to have students acquire the basic knowledge of quantum mechanics that explains the structure, electronic structure, optical and electrical characteristics of materials, and aims for the following:
(1) Learn about the birth, history, hypotheses and basic concepts of quantum mechanics,
(2) Gain quantum-mechanical understanding of basic motions such as translation, rotation, vibration, etc. of atoms and molecules,
(3) Understand material-light interactions and spectroscopic and everyday quantum-mechanical phenomena,
(4) Be a prerequisite subject for the understanding of the electronic structure, optical and electrical properties and chemical bond of materials, and
(5) Be a prerequisite subject for the understanding of computational chemistry using computers.

MA4214 Materials Characterization [3:0:3]
This course deals with theories and methodologies of material analysis from wave interferences to element and structural analyses. Students will learn the structures of crystals, amorphous metals and ceramic polymers as well as the principles of imaging, and also study precise material analysis methods at the atomic and molecular levels.

MA4215 Advanced Polymer Synthesis [3:0:3]
This course deals with nomenclature based on the chemical structures of polymers and the basics of chain polymerization and step polymerization, two common polymer synthesis methods. Moreover, the course examines the characteristics of various living polymerization (ion polymerization, group transfer polymerization, metathesis polymerization, coordination polymerization and immortal polymerization), which can precisely control the primary chemical structures of polymers.

MA4217 Energy Materials [3:0:3]
This course aims for students to gain an in-depth understanding of energy storage and conversion systems, and the materials needed, including fuel cells (polymer electrolytes, solid oxides, phosphate, molten carbonate fuel cells, etc.), batteries (lithium-ion, lithium-air, lithium-sulfur, flow batteries, etc.), hydrogen production and storage materials and systems, and electrochemical capacitors. The course will also include contents on the fundamentals of electrochemistry, which is the driving principle, in order to better understand how each of the energy systems and materials works. Furthermore, the course will investigate practical electrochemical energy materials and system analysis techniques such as CV and EIS.

MA4218 Physical Chemistry of Surfaces [3:0:3]
This course lectures on surfaces, which serve as a critical role in nano-sized materials and devices, particularly on technology to investigate the surface structure and characteristics and the physical and chemical properties of surfaces and interfaces. Also, the course aims to have students understand the thermodynamic and electrical characteristics of surfaces by using the knowledge of 2D thermodynamics, statistical thermodynamics and quantum chemistry. Moreover, lectures will also be conducted on the interfaces and surfaces of adsorption isotherm, catalysts, nano particles and soft substances.

MA4219 Printable Electronics [3:0:3]
The main purpose of this course is for students to gain understanding on the basic concepts, mechanisms, and current issues in recent "Flexible and Printable Electronics" (FPEs), which utilizes novel metallic and semiconducting materials processed from solutions. This course will cover the entire aspects for future FPEs, including flexible substrates, flexible and transparent electrodes, flexible encapsulation layer, printable photoactive layers, printable functional layers, and various printing technologies. After covering the basic issues for FPEs, this course will focus on the materials and device issues for 'flexible and printable organic solar cells' and 'hybrid perovskite solar cells.'

MA4220 Structure Property Relationship of Polymers [3:0:3]
The main purpose of this course is to collect and organize students' understanding of the relationships between structure, properties & applications of polymer materials. Important polymer properties such as processability, mechanical, thermal, electrical, optical, acoustic, chemical and surface properties will be discussed from various aspects of polymer structures.

MA9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

MA9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

MA9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

8. Earth Sciences and Environmental Engineering

A. Overview of concentration

The warming earth, polluted environment and the need for sustainable energy and water are the biggest assignments that mankind is faced with today. The concentration of Earth Sciences and Environmental Engineering has established both basic courses and specialized concentration courses on areas of study needed to understand the environmental changes and phenomena taking place on the earth we live in, improve the contaminated environment and maintain sustainable life. In particular, the distinct

characteristic of Earth Sciences and Environmental Engineering courses is that it comprises subjects specialized for the understanding of environmental phenomena, including general sciences of Physics, Chemistry, Biology and Earth Sciences that can help students sufficiently complete subjects including Thermodynamics, Geophysics, Atmospheric Dynamics, Industrial Mathematics, Calculations of Substances, Unit Operations, Inorganic Chemistry, Organic Chemistry, Aquatic Chemistry, Soil Chemistry, Electrochemistry, Biochemistry and Microbiology. Such background is set up in this manner because the ultimate educational objective pursued by Earth Sciences and Environmental Engineering is the development of experts who are able to comprehensively understand the complex phenomena of various environmental media based on deep understanding of the foundati onal study. In the 1st stage of the concentration intensive curriculum, students who have completed basic courses will enroll in transport phenomena, environmental monitoring, environmental modeling, device analyses and experiments, fluid mechanics, reaction engineering, numerical analysis and sustainable energy engineering. All of these are required of students under conditions to which the characteristics of various environmental media are designated, from the earth environment, climate change and environmental motion to the atmosphere, ocean, water quality and soil. The 2nd stage of the concentration intensive curriculum include courses such as air pollution, water pollution, soil pollution, physicochemical processing, biological processing, treatment process design, environmental restoration, environmental energy engineering and environmental statistics. In particular, the c oncentration intensive courses are associated with the advancement to graduate school and constituted for students to conduct more in-depth studies and research. Students in the conce ntration of Earth Sciences and Environmental Engineering will be trained to gain the knowledge and experience in areas, which include the climate change response, prevention of environmental pollution and the technology to secure future energy and water resources, need of national foundation technologies and future convergence technologies for the realization of a sustainable society.

B. Overview of courses

EV3101 Environmental Engineering [3:0:3]

As a subject on the fundamental concepts of Environmental Engineering, which deals with water, air and energy, as a whole, this course examines the basic theories needed to fix and solve environmental issues, based on chemistry, biology and physics. The contents of the course include mass and energy balance, chemical reaction engineering, drinking water and wastewater treatment engineering, atmospheric science, field purification, energy, environmental regulations and policies, ethics, etc.

EV3106 Environmental Laboratory I [1:4:3]

In Environmental Laboratory I, students will perform experiments on environmental issues examined in lectures and assignments, including basic water treatment and air pollution such as fine dust, and, through the experiments, seek to learn the basic concepts of Environmental Engineering and to build the capacity in collecting and analyzing engineering data.

EV3111 Earth and Environmental Sciences [3:0:3]

This course has been constituted to include several general areas by reflecting the characteristics of Earth on which physical, chemical and biological mechanisms interact. In particular, to emphasize the connection between Earth's atmosphere and hydrosphere, the course has been designed for students to learn air-sea interactions after examining atmospheric thermodynamics, atmospheric chemistry, marine physics, marine chemistry and marine biology.

EV4106 Earth & Environmental Transport Phenomena [3:0:3]
This course studies the flows of heat, materials and momentum occurring throughout the globe by using the basic concepts of transport phenomena. The course enables students to learn about the elementary and comprehensive details of transport phenomena to cultivate their ability to apply them to a number of environmental systems.

EV4107 Environmental Laboratory II [1:4:3]
In Environmental Laboratory II, students will perform experiments on environmental issues examined in lectures and assignments, including the basic treatment of water such as sewage and environmental processing utilizing microorganisms and, through the experiments, seek to learn the basic concepts of Environmental Engineering and to build the capacity in collecting and analyzing engineering data.

EV2208 Analytical Chemistry [3:0:3]
This course provides students with an understanding in the basic principles of qualitative and quantitative analyses used in different areas of chemistry and science. The first part of the course will deal with the methods of analysis of data obtained by scientific measurements as well as the fundamentals of statistics. Then, students will learn about the background theories of various qualitative analysis methods and study cases in which analytical chemistry is applied in life sciences and environmental science outside of chemistry.

EV3205 Environmental Ecology [3:0:3]
Environmental Ecology is a subject that seeks to have students understand the structure, functions and characteristics of the environmental ecosystem and to study the solutions. The course aims for students to grasp the basic principles of the ecosystem and its connection to environmental issues, understand the flows of energy and materials as well as the interactions with the Earth environment, and build their problem-solving capacity for natural environment issues through, for example, ecological restoration techniques.

EV3213 Genetics [3:0:3]
In this course, students learn the basic concepts of genetics and the applications of genetics are studied to understand complex life phenomena that take place at various levels such as molecular, cellular and multi-cellular. Major contents to be covered include the structure and functions of genes, chromosomes and dielectric substances, Mendelian inheritance, genetic mapping, molecular genetics, genetic variants, genetic clustering, functional analysis of protein utilizing techniques of genetics, gene expression analysis, and understanding of genetic diseases.

EV3214 Bioorganic Chemistry [3:0:3]
The first part of this course deals with the structure and chemistry of monomers of biomolecules, which include amino acids/proteins, carbohydrates/oligosaccharides, and nucleotides/nucleic acids, and biopolymers. Students will be able to comprehend the path and mechanisms of biosynthesis of such biomolecules, and study the reaction within living bodies with which enzymes and ristocetins are involved. As relevant topics, bio-mimetic chemistry, macromolecular chemistry and medicinal chemistry will be briefly introduced in the latter part of the course.

EV3215 Water Supply and Wastewater Engineering [3:0:3]
This course aims for students to understand the elementary structure and principles of water supply catchment and drainage systems, planning and design of supply and drainage of water, and the concepts of water treatment unit processes (preprocessing, aggregation, precipitation, filtration and disinfection). Also, the course seeks to familiarize students on the basic structure and principles of wastewater and sewage treatment systems as well as the principles of sludge processing.

EV3216 Biochemistry II [3:0:3]
Biochemistry is a course in which students learn all about the chemical phenomena that take place in a living organism. The course will be taught in two courses, I and II, and the primary textbook of the course is [*Biochemistry (5e*) by Garrett & Grisham]. In Biochemistry II, more intensive chemical principles of life phenomena will be introduced based on the fundamental knowledge learned in Biochemistry I. The course will deal with the creation and storage of bioenergy, biosynthesis, and control during decomposition with a focus on bioenergy metabolism that takes place in cells. Subtopics include 1) understanding the concept of biometabolism, 2) biosynthesis and storage of sugar, 3) biosynthesis and biodegradation of lipids and steroid, and 4) biosynthesis of amino acids and nucleic acids. Also, the course additionally studies protein folding, gene expression and replication and signal transmission to materialize relevant knowledge. This course will provide the basics needed to understand more intensive biology subjects including Molecular Biology, Cell Biology, Pharmacy, Medicinal Chemistry, Chemical Biology and Genetics.

EV3217 Microbiology [3:0:3]
Microorganisms generally refer to living organisms made of single cells and, in a broad sense, include protists and fungi of eukaryotes, prokaryotes and viruses. In fact, microorganisms are small organisms that can be seen only through microscopes but serve an extremely important role in the organism environment. The course of Microbiology first focuses on understanding the characteristics that can define microorganisms and the principles of the classification system according to the characteristics. After learning about the general characteristics of microorganisms, the ultimate goal of the course is for students to understand the direct and indirect effect of microorganisms on the actual environment and unit living organisms.

EV3218 Fluid Mechanics [3:1:3]
This course covers the basic concepts of fluid mechanics and how to apply it to notable flow systems. Major topics include the characteristics of fluids, basic mechanics of flow, governing equation of flow, dimensional analysis and similarity and viscous fluids.

EV3219 Mathematical Methods of Physics I [3:0:3]
This course deals with various topics corresponding to basic- and intermediate-level mathematical physics. The course focuses on the understanding of fundamental principles rather than arithmetic calculations.
Principle of coordinate transformation
- Understanding of scalar field and vector field based on coordinate transformation
- Divergence, curl, gradient, Laplacian, etc. in a general coordinate system
- Comparison of Sturm-Liouville system and self-adjoint operator
- Fourier, Laplace, Legendre transformation, etc.

The course concentrates on the understanding of these fundamental principles instead of their meanings, theorems and arithmetic calculations.

EV4201 Earth & Environmental Systems Modeling [3:0:3]
This course aims for students to gain the basic mathematical knowledge needed for the modeling of environmental systems, and analyze and optimize them by using the latest computational approach. First, the course studies the basic concepts of environmental system modeling, mathematics to understand and scientifically express the systems, and fundamental optimization techniques to optimize the systems. Through this, students learn how to scientifically analyze the environmental systems and gain basic knowledge on the composition and optimization of the model.

EV4202 Biogeochemistry [3:0:3]
This course deals with Earth's dynamic system constituted of biological, physical and chemical phenomena. Biogeochemistry primarily examines the circulation of energy and elements between the biosphere and geosphere, notably the circulation of water, carbon, sulfur and nitrogen. Through this course, students will be able to understand the biological, physical and chemical roles of the biosphere and geosphere that form the Earth.

EV4203 Marine Physics [3:0:3]
Marine Physics is a subject for the understanding of the physical characteristics of oceans and basic theories of sea currents, fundamental theories of ocean waves and tides, and physical elements of the marine environment including seawater circulation by atmospheric movements.

EV4204 Unit Operations of Environmental Processes [3:0:3]
This course, Unit Operations of Environmental Processes, aims for students to understand the principles and characteristics of each of the unit operations in environmental processes such as the processing of pollutants in water and air. Based on the basic background of chemical and biological processing, the course seeks to cultivate engineering knowledge in processing and operation of each process through material delivery and transport phenomena.

EV4205 Environmental Processes Laboratory [1:4:3]
Environmental Processes Laboratory aims to have students conduct basic experiments related to environmental processes. Through lab-scale experiments in water treatment and various environmental processes, students will gain practical training in environmental engineering and cultivate their ability to apply the training in the field and research.

EV4209 Electrochemical Technology [3:0:3]
This course aims to take oxidation and deoxidation, the fundamental principles of electrochemistry, and explain the industrialized area to students. In detail, the course will introduce electroplating used in energy and semiconductor processes, corrosion and anti-corrosion with a long history, wastewater treatment and sterilization using electrodes (catalysis, absorption-desorption process), chemical cells regarded as the energy source of the future (fuel cell, electrolysis), and batteries that are being used in our daily lives.

EV4210 Energy Chemistry [2:2:3]
Energy Chemistry teaches students on chemistry related to the storage and conversion processes of energy including energy efficiency. Topics of the lectures include the overview of new energy technologies, physical and electrochemical principles related to the conversion of chemical and electrical energy, thermodynamics and materials.

EV4211 Air Pollution Engineering [3:0:3]
This course aims to not only impart to students the basic knowledge of substances that cause air pollution, which affects the health of people and brings about social and economic damage, but also have them discuss the generation of pollutants and the technology of measurement, analysis and elimination.

EV4212 Aquatic Chemistry [3:0:3]
This course deals with the fundamental behaviors of inorganic materials in water. The course primarily examines chemical equilibrium including the topics of acid-base, formation of complex compounds, eduction and dissolution, and oxidation-deoxidation reaction. Basic kinetics is also covered in the course. Through the course, students will acquire the ability to discern the composition of materials in the state of equilibrium under a given aquatic environment and to, also, cultivate their intuition for the behaviors of materials in a complex system.

EV4213 Basic Environmental Toxicology [3:0:3]
This course deals with the behaviors of pollutants, which are hazardous to mankind and the ecosystem, within an environment as well as changes in toxicity according to chemical changes. Major contents include toxicity mechanism, chemical behavior, ecological toxicology, classification of toxic pollutants, toxicity testing methods and risk assessments.

EV4214 Atmospheric Chemistry & Climate Change I [3:0:3]
This course focuses on chemical reactions that occur in Earth's atmosphere, primarily dealing with the interactions between the atmosphere and biosphere of Earth. The course will entail the understanding of the atmosphere in the natural state and polluted state as well as controversial environmental issues such as the destruction of the ozone layer, acid rain, smog and climate change. Through this course, students will be able to cultivate the basic grounding for comprehending the root causes of various environmental issues and their mechanisms.

EV4215 Statistics for Earth and Environmental Science [3:0:3]
This course teaches students how to process and statistically analyze various environmental data on the phenomena that can be observed in Earth's environment. Students will primarily analyze the correlation among the data to statistically approach and evaluate the effects of environmental factors. Through the course, students nurture fundamental skills such as environmental data management and processing and also learn how to statistically and effectively analyze the complex environment system in which a variety of environmental factors coexist.

EV4216 Environmental Chemistry [3:0:3]
This course aims to have students gain a fundamental understanding of major chemical reactions and processes happening in environment media (water, soil, air) and to cultivate their ability to quantitatively describe the behaviors and transformations of (organic and inorganic) elements and chemical pollutants through the methods of thermodynamics and chemical kinetics.

EV4217 Atmospheric Chemistry & Climate Change II [3:0:3]
In Atmospheric Chemistry & Climate Change II, the contents that have been dealt with in Atmospheric Chemistry & Climate Change I will be learned in a more intensive manner, and include topics such as meteorological change, climate change and, even, global change related to atmospheric chemistry.

EV4218 Earth and Environmental Thermodynamics [3:0:3]
In Earth and Environmental Thermodynamics, students will study the fundamental concepts of thermodynamics, which is to discuss the macroscopic properties of natural and artificial systems, as well as energy and its delivery and analysis, and kinetics. Based on this knowledge, the course seeks students to understand the interactions among various environmental factors and the reaction mechanism for environmental control.

EV4221 Fine Particle Measurement [2:2:3]
This course aims to not only impart to students the basic knowledge of substances that cause air pollution, which affects the health of people and brings social and economic damage, but also have them discuss the generation of pollutants and the technology of measurement, analysis and elimination.

EV4222 Air Quality Study Trend [1:0:1]
This course was established to not only cultivate first-rate knowledge by having students understand the latest trends in research of air quality using advanced equipment but also perceive the importance of cooperation and constructive criticism through understanding of such research processes. Thus, students will be able to engage in air quality research that suits different purposes and cultivate their ability to analyze simple data through the examples of actual research.

EV4223 Instrumental Analysis [3:0:3]
This course provides students with the basic understanding of the operating principles of modern analytical instruments. In the course, students will learn about different methods of segregation analyses such as spectrophotometry, atomic spectrometry, and mass spectrometry as well as gas chromatography, liquid chromatography and capillary electrophoresis, and have the opportunity to present their research papers on instrumental analysis.

EV4224 Air Quality Data Analysis and Its Application I [3:0:3]
This course aims to foster experts who can make correct valuation by objectively understanding data in the midst of a flood of air quality-related information. The course not only introduces current air quality issues that mankind faces today but also analyzes and distinguishes public materials that can be utilized worldwide (for example, NASA, NOAA, Air Korea, etc.). Through this, students are expected to cultivate their ability to more proactively respond to the changing atmospheric environment and the phenomenon of deteriorated air quality.

EV4225 Understanding Climate Change [3:0:3]
With the goal of introducing and becoming familiar with climate change as a whole, this course covers 1) global energy balance, 2) circulation of air and ocean, and 3) climate of the past, present and future. Mathematical understanding is required, and STAR-MOOC lectures will be utilized as a part of this course, which will proceed in the order of online lectures, presentations and review lectures.

EV9101 Undergraduate Thesis Research [3]
This is the course for students in the Class of 2010 through 2014 to write their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

EV9102 Undergraduate Thesis Research I [3]
This is the course for students in the Class of 2015 or later to prepare for their undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate thesis, which needs to pass the thesis screening.

EV9103 Undergraduate Thesis Research II [3]
This is the course for students in the Class of 2015 or later to write their final undergraduate thesis. Based on Undergraduate Thesis Research applications approved by thesis academic advisers, students must conduct individual research and write and submit their undergraduate theses, which needs to pass the thesis screening.

9. Minor programs

A. Mathematics minor

1) Overview

Mathematics is a fundamental subject for all areas of science and engineering and is the most outstanding academic system for raising logical thinking, thus is a basic qualification of all studies. As a science-specialized, government-funded institution that grows talents who will lead the country's science and technology of the future, GIST operates the Mathematics minor program to provide its students with a diverse curriculum for them to build a solid mathematical foundation needed in science and engineering education and research and to expand their opportunities to cultivate strict and logical thinking.

2) Overview of courses

MM2001 Multivariable Calculus & Applications [3:1:3]
The course deals with calculus of multivariable functions and vector functions as well as their basic concepts and applications. The course is based on a vector function's continuity, differentiability, directional differentiation and geometric structural analysis, and aims to have students understand theories on multiple integrals, line integrals and surface integrals. Through this course, students are able to establish abstract concepts and learn basic proofs with increased mathematical strictness.

MM2002 Differential Equations & Applications [3:1:3]
This course studies the establishment and solutions of differential equations, an essential element of mathematics and engineering, as well as their applications to natural sciences and engineering. Students learn about the existence and uniqueness of the solutions of ordinary differential equations, linear differential equations, systems of linear differential equations, Laplace transform, Fourier series, overview and numerical solutions of partial differential equations, etc.

MM2004 Introduction to Linear Algebra & Applications [3:1:3]
Linear algebra is a fundamental prerequisite course in mathematics and a required subject for science and engineering majors along with calculus. In this course, students gain in-depth understanding of vector spaces, which is a basic concept of algebra, and linear deformation among these as well as the theory on matrices expressing vector spaces. In addition to geometry and differential equations, students also study applications and utilization in signal processing, control theory and other aspects of engineering majors.

MM2006 Foundations of Mathematical Thinking [3:0:3]
This course can be utilized as a prerequisite for students who have completed all courses required for general mathematics and wish to go on to take upper-level courses (electives) in mathematics or subjects in need of induction and abstraction. By examining the concepts that form the most basic foundation for various fields of mathematics and the process of strict proofs, mathematical thinking is developed and the method of abstraction is learned. The course introduces the exact meanings of axioms, definitions, theorems and proofs, and the methods of proof and induction, and trains students to apply them.

MM2007 Introduction to Mathematical Thinking [3:0:3]
In this course, how to think mathematically is developed and how to precisely prove oneslef in the axiomatic system is trained. To foster the ability of reasoning, students must be able to interpret mathematical texts precisely and express their own thoughts accurately with a language. In addition, text reading, discussion and mathematical writing (proof) as well as the basic methods needed for mathematical thinking are learned. (This course is based on the number system, functions and induction, and deals with the basics of the number theory, counting, continuity of real numbers, the concept of infinity, continuity of functions and the system of complex numbers.)
Also, examples in which mathematical thinking is utilized in daily life or various fields of other studies are discovered and analyzed, and students develop the ability to think and differentiate examples in which it is properly utilized from those that are incorrectly used.

MM2011 Multivariable Calculus & Applications – Honors [3:1:3]
This course covers vector calculus of multi-variable functions providing rigorous proofs and theoretical background.

MM3001 Real Analysis & Applications [3:0:3]
This is a course that deals with systematic contents of the theory of real functions and introduces contents such as the system of real numbers, limits of real functions, continuity, differentials, integrals and Riemann integral. Students will be able to understand the proof of a theorem that uses ε - δ and learn the fundamental concepts of analysis. The course enables students to develop mathematical and analytical logics and trains their ability to read and write proofs. In addition, the course teaches the applications enabled through real analysis.

MM3012 Mathematical Modeling for Engineers [3:3:2]
During the summer break of 2016, Professor Rachel Levy of Harvey Mudd College, an engineering institution among the renowned Liberal Arts Colleges in the U.S., was invited to hold a mathematics-engineering integrated subject for the undergraduate students at GIST. Originally designed based on the Engineering Mathematics (E72) course, which is currently run at Harvey Mudd College, this course comprehensively teaches students the necessary contents of engineering through demonstrations of actual engineering problems, mini-lectures of mathematical logic that forms the basis of mathematical modeling, group work for increased understanding and, even, numerical analysis through Matlab programming. The course covers mathematical techniques and applicability and especially aims for students to develop virtues such as “mathematical confidence, the ability to differentiate suitable mathematical tools for given engineering problems, discernment on the accuracy of calculated solutions, acquisition of analytical and computational capacity, and patience, which is a necessity in solving complicated problems.”

MM3015 Probability and Statistics [3:0:3]
This course, “Probability and Statistics” (or “Basic Statistics”), studies the basics of statistical thinking for qualitative and quantitative data analyses needed in completing a college curriculum. Also, for students who wish to major in fields that require a great deal of mathematical, statistical or quantitative analyses, this course enables them to be equipped with a numerical foundation of the scientific analysis method and to nurture their capacity to take upper-level courses.

MM4002 Complex Analysis & Applications [3:0:3]
This is a course in which the basics of complex numbers and complex functions are learned. Applications of Complex Analysis can be found not only in various fields of mathematics including the number theory and applied mathematics but also in physics. In this course, the definitions of various types of complex variable functions and their continuity, differentiability and analysis based on the computation of complex numbers are studied, and the most important results in Complex Analysis are learned including the Taylor series, Laurent series, Liouville’s theorem, Cauchy’s theorem, analytic continuation and Riemann mapping theorem. Also, the course introduces students to the integration, meaning and application of complex functions such as Fourier transform.

MM4003 Partial Differential Equation & Applications [3:0:3]
Partial differential equations is a field broadly used in mathematics, science and engineering, and this course aims to have students develop the ability to apply the knowledge of differentiation and differential equations to modeling and simulations.

MM4004 Abstract Algebra [3:0:3]
This course introduces the group theory, ring theory and field theory, which form the basic concepts of Abstract Algebra. This course allows students to learn abstraction in a more systematically manner and the course also introduces the application of group or field that are used in various other fields.

MM4005 Scientific Programming [3:0:3]
In this course, students will first learn basic programming languages (C, C++ language, etc.). Students will then learn the fundamentals of scientific programming through the environment for scientific computing and a few real cases including the basic understanding of UNIX OS and visualization, which are for high-performance computing needed to execute computational science.

MM4006 Elementary and Analytic Number Theory & Applications [3:0:3]
This course studies the basic concept and applications of the traditional elementary number theory and the basics of the analytic number theory, which form the basis of the prime number theorem.

MM4007 Geometry I [3:0:3]
Based on calculus and linear algebra, this course aims for students to understand Euclidean geometry and non-Euclidean geometry. To study the geometry of curved surfaces, a basic understanding on differential equations is needed and, for the understanding of isometry, a symmetric group is required.

MM4008 Monte Carlo Methods and their Applications [3:0:3]
This course is an intensive course of the subject of scientific computing, and studies the fundamentals of (dynamic) Monte Carlo Methods needed in the nano age as well as the applications of the Monte Carlo scientific research through the characteristics of such methods and several actual cases.

MM4009 Graph Theory [3:0:3]
In this course, students learn about a number of mathematical properties of graphs, which form the foundation of computer and network theories. Students will examine graphs and various relevant basic concepts, tree structure, matching, factor, connectivity, coloring, planar graphs, Ramsey Theory, etc. based on strict proofs, and will also study methodologies such as the Algebraic method and probabilistic method. Also, the course deals with examples in areas in which they are actually applied.

MM4010 Discrete Mathematics [3:0:3]
This course deals with the principles of discrete mathematics and various methods of handling discrete mathematics, which forms the basis of computer theory. Also, the course teaches students the concepts and methods of fundamental logic and formal mathematical proof in need of mathematical thinking.

MM4015 Scientific Computing [3:0:3]
This course is an elective from general mathematics courses available for selection by students in the majors of natural sciences and engineering who are also interested in computational science. The course begins with the introduction of scientific computer, a mathematical languaage of computational science, and deals with necessary concepts and application problems. Students will learn the finite element method's initial value problems, boundary value problems, the solution of a system of linear equations, and nonlinear problems, all of which are basic problems in scientific computing. In addition to the finite element method, the Monte Carlo method, a probabilistic methodology, will be introduced.

MM4016 Introduction to Topology [3:0:3]
This course is aimed to offer students a basic introduction to topological properties of spaces, like continuity, convergence, compactness, metric spaces and metrizability. If time permits (although unlikely), the concept of the fundamental group will be discussed.

MM4017 Mathematica & Symbolic Computing [3:1:3]
Over two semesters, this course deals with symbolic computing using Mathematica and applies this to discover the solutions of various problems frequently encountered in mathematics, science and engineering. Main topics include the formula of conversion, equation solutions, differential calculus, vector analysis, discrete mathematics, operator analysis, visuals and graphics. Based on these, students will apply symbolic computing and deal with the associated systems theory, electromagnetism, signal processing, etc.

MM4018 Mathematica for Topics in Mathematical Sciences [3:1:3]
The aim of this course is to have students understand the topics in mathematical sciences and the application of Mathematica including the symbolica package. At the end of each topic, students are required to solve given problems using Mathematica and present their solutions. The first topic is modeling in mathematical biology, namely the Keller-Segel model of chemotaxis. The second topic is simple models in general relativity described using differential geometry. The third topic is fluid dynamics, aiming to understand the Navier Stokes equation which is regarded as the most challenging PDE. To understand these topics, knowledge in vector calculus and differential equations is required.

B. Humanities and Social Sciences minor

1) Overview

The minor aims to provide GIST College students the opportunity to obtain the qualifications to complete a minor in the field of Humanities and Social Sciences upon graduation and to imbue a motivation for learning various areas of humanities and social sciences in addition to science and engineering concentration courses. The minor also offers institutional support tailored to the individual needs of students who either wish to focus their studies in specific areas of humanities and social sciences or are interested in convergence areas such as Culture Technology.

In the Humanities and Social Sciences minor, students may choose either an ① (individual field) minor, which is based on the completion of subjects in a single area, or an ② associated minor (of multiple fields), which is based on the completion of subjects in two areas. Individual field minors include those in academically established areas and are expected to be a stepping stone in terms of external usage when entering into relevant fields. Associated minors of multiple fields are designed and operated through a flexible combination of two areas based on convergence and consilience that encourage hybridization.

2) Status of organization of courses

○ Humanities

○ Social Sciences

※ Refer to the details on the College website.

3) Overview of courses

※ Refer to the overview of the courses set up in the Division of Liberal Arts and Sciences.

C. Energy minor

1) Overview

From within the integrated education curriculum at the School of Integrated Technology, the integrated talent fostering program for the development of new, renewable and eco-friendly energy technology is offered to GIST students as a minor, thus aiming to provide opportunities to experience diversity in the area of integrated research.

2) Overview of courses

ET2101 Energy and Future Society [1:0:1]

In the era of energy integration and the Paris Agreement, this course aims to cover not only the importance of the fields of energy conversion and storage, power conversion, and transfer and device control, all of which are core technologies in sustainable energy systems, but also their technological and political issues. The course will also introduce students to changes in the energy mix in industries, traffic and transportation and the residential environment, and explain how such technologies will change the means of future mobility (electric vehicles, hydrogen fuel cell vehicles), drones, robots, smart devices, IoT and other elements of logistics and home lives.

ET4102 Energy Engineering [3:0:3]

This course covers the minimum amount of engineering knowledge that a green energy expert must be equipped with as well as various technological and political energy issues. The lectures of the course will focus on the concept and issues of energy, basic theories of thermodynamics and reaction, usable energy (coal, petroleum, natural gas, nuclear energy), current status and development issues of major forms of new and renewable energy (hydrogen, fuel cell, solar heat and sunlight, wind power, bioenergy), key energy conversion and storage technology (batteries), high-efficiency energy technology (heat pumps, LED, superconductivity), and other environmental and energy issues (climate change, CCS).

ET4201 Energy Conversion and Storage [3:0:3]

In the course, students will acquire a theoretical foundation on mutual conversion between electrical energy and other various forms of energy, and characteristic conversion between homogenous energies. In addition, students will study the materials, devices and systems for efficient conversion and storage of energy.

ET4302 Smart Grid and Power Electronics Applications [3:0:3]

This course introduces new and renewable energy including smart grids, wind power and solar power, and students will become familiar with rectifiers, inverters and various converters used such as cyclo-converters. The course also presents hundreds of examples of the practical application of power electronics technology centered on alternating current circuits, and enables students to perform simple exercises of designing power electronics circuits.

ET4303 Management Science in Energy System Economics [3:0:3]

This course outlines the principles of the competitive energy industry based on the management science theory. The basic concepts of management science and economic theory in terms of the structure, planning,

and operation of the competitive energy industry are briefly presented to students to allow them to gain understanding of the development of the new energy industry.

ET4304 Power Electronics [3:0:3]
Power electronics is a field that deals with the conversion and control of power by controlling power semiconductors. This course aims for students to understand the basic circuit operations of power electronics. Students are introduced to basic power conversion circuits that are widely used and become familiar with the operating principles through steady-state analyses.

ET4305 Renewable Energy and Microgrid [3:0:3]
This course aims for students to grasp the operating principles and characteristics of major sources of new-renewable energy from the standpoint of power system. The course also introduces the concept of microgrid, a small-scale power system that solves the issues caused by renewable energy in power systems and supplies energy in a stable manner. Moreover, the course examines comprehensive issues in the connection of renewable energy to power systems.

ET4501 Understanding of Solar Cells [3:0:3]
This course deals with the basic principles and applications of solar cells for which the optical and electrical characteristics of metals and semiconductor materials will be explained. Also, the course will present the status of present-day research on various types of solar cells.

D. Biomedical Engineering minor

1) Overview

From within the education curriculum of the Department of Biomedical Science and Engineering, the integrated talent fostering program in the area of biomedical engineering and medical science is offered to GIST students as a minor, thus aiming to provide opportunities to encounter diverse experiences in the area of biomedical research. For students to experience the basic concepts and a range of academic areas within the field of biomedicine, the curriculum offers Introduction to Medical Engineering as a recommended basic course. Those who complete the basic course will move onto the concentration intensive stage and select Medical Imaging, Biomedical Optics, Biosignal Processing, Neuroscience Technology, Medical Terminology in the Field of Biomedicine, Neuroscience, Human Molecular Genetics and Clinical Neuroscience for an opportunity to receive in-depth academic education directly related to the specialized graduate school curriculum. By enrolling in the Biomedical Engineering minor program, students are expected to grow into outstanding talents who can perform creative research applicable to the field of medicine.

2) Overview of courses

MD2101 Introduction to Medical Engineering [2:0:2]
This course explains biosignals that can be obtained from a human body and the methods to obtain them and, based on this, introduces students to the principle and system of diagnostic and treatment technologies, which are actually used in clinical applications.

MD4101 Neuroscience Technology [3:0:3]
The growth of neuroscience accelerates as new methodologies and imaging technology progress. This course aims to not only introduce various research methodologies in neuroscience, but also visualize and control structures and functions of the brain. Furthermore, in this course, we comprehensively cover topics including research methods at the in vitro neuron level, for brain slices and for the cerebrum of in vivo animal. Also, the course looks into neurotechnological and neurophotonic approaches for brain diseases such as stroke.

MD4102 Clinical Neuroscience [3:0:3]
This course provides the basic understanding of general neuropathy that demands new diagnoses and therapy intervention. In addition, the course will cover fundamental neuroanatomy, pathological physiology, clinical symptoms, methods of diagnoses and treatment and, through this, students will be able to understand the basic mechanism for the clinical management of nerve disorders. Moreover, the course will provide ideas for students to be able to innovate the typical neurological and traditional methods of diagnoses and treatment.

MD4301 Biosignal Processing [3:0:3]
This course studies the fundamental knowledge of signal processing, which is required in biosignal and neuroscience research. Moreover, students will be asked to use programming languages such as Matlab to actually materialize the signal processing theory and train their ability to analyze signals of the physical system.

MD4302 Medical Imaging [3:0:3]
This course introduces students to the basic physical operating principles of today's imaging devices as well as their hardware and clinical applications.

MD4303 Biomedical Optics [3:0:3]
The major contents of this course include the fundamentals of optical microscopes for biological experiments and medical research, design of optical microscopes and core image processing. The course begins with the basics of optics and the principle of image composition and also examines the operating principles and usage of various general optical microscopes. Moreover, students in the course will investigate the quantitative analytical method of information obtained by recently proposed and utilized optical microscopes (fluorescent, second harmonic, Raman signal, etc.).

MD4501 Neuroscience [3:0:3]
The growth of neuroscience accelerates as new methodologies and imaging technology progress. This course aims to not only introduce various research methodologies in neuroscience, but also visualize and control structures and functions of the brain. Furthermore, in this course, we comprehensively cover topics including research methods at the in vitro neuron level, for brain slices and for the cerebrum of in vivo animal. Also, the course looks into neurotechnological and neurophotonic approaches for brain diseases such as stroke.

MD4502 Human Molecular Genetics [3:0:3]
This course aims to have students become familiar with the details of human molecular genetics and various areas of medicine to which it is being applied. The course seeks students to grasp the latest technological status and industrial characteristics of genetics and, through this, solidify a foundation to pioneer in the area of diagnosis, treatment and prevention that may be applied to patients.

MD4601 Medical Terminology [3:0:3]
Most of the terms used in the field of medicine ("Medical Terminology") have Latin or Greek origins. This is a course that aims for students to comprehend the basic meanings of the etymology of medical terminology and introduce the means to analyze and understand the composition of terms. The contents of the course focus on understanding the meanings of medical terms used in human anatomy, physiology, pathology, infectious diseases, pharmacology and clinical medicine.

E. Culture Technology minor

1) Overview

By providing GIST undergraduate students with courses in cultural contents and culture technology as a minor, the school aims to foster integrated talents in the field of culture technology who will lead the future domestic and international media contents market.

2) Overview of courses

CT2501 Understanding Otaku and Popular Culture [3:0:3]

Many of the new domains of today's pop culture are being populated with Otaku-style subcultures in comics, animations, games, light novels, etc. This pop culture phenomenon originating from Japan has overcome borders and is now quite familiar even in Korea with the term, "Odeok," a derivative of "Otaku." This course aims to examine the phenomenon and characteristics of Otaku culture, widely regarded as a new cultural phenomenon, by area and case in a historical perspective, and the course aims to understand this phenomenon along with the macroscopic social, political and economic context, as well.

CT2502 Understanding Modern Art [3:0:3]

Since the mid-19th century, art has been functioning as a counter-discourse in a capitalistic society governed by instrumental rationality through the critical sense of identity and aesthetic sensibility of artists as well as the radicalness of critical discussions about the works. This course aims to have students understand the trends and characteristics of complex art, which is differentiated by terms such as modernism, postmodernism and pluralistic culture, and imagine an alternative world based on sensitivity.

CT2503 Korean Narratives and Our Life [3:0:3]

The concept of story was born the day humans first began to live on this earth. Stories traveled from the mouth of one person to the next before spreading broadly among many people and, in the midst of the flow of time, they have constantly changed the accounts like a living creature. Of course, new stories continue to be created as we speak. The stories that have been handed down to this day formed classical narratives.

This course aims to not only read, enjoy and critique major works of narratives within our classics but also critically and creatively reflect on various issues that we are facing today. To achieve this, we must begin from today's perspectives, or our critical minds. We will find ways to solve problems as we deeply think about what kinds of questions our narratives and, furthermore, humanities, will pose regarding the problems "here and now" and, based on this, which new questions we are going to have to pose. Also, connecting such thoughts and means to the solutions with the production of new "contents" is one of the primary objectives of this course.

CT2504 Utopian Fiction and Technology [3:0:3]

This course examines Platon's 『*Politeia*』 and Thomas More's 『*Utopia*』 as well as the universe utopia in the latest science fiction, and explores how the ideal of "utopia" has appeared and been developed in Western thoughts and literary imagination. In particular, the course concentrates on the essential role of science and engineering in Western utopia fiction, which imagine the realization of people's happiness (and simultaneously criticize the existing injustice and irrationality of reality) within the non-existing (u-topic) and ideal (eu-topic) society, and also seeks diverse discussions. The list of books includes classical utopia fiction such as More's 『*Utopia*』 (1516) and William Morris' 『*News from Nowhere*』 (1980) as well as recent controversial works in which issues of the so-called postmodern and post-human era including ethnicity and colonialism, gender and reproductive technology, labor and private properties, and civil freedom and control complicatedly intersect. This is a fusion course that demands intensive writing containing in-depth analyses and critique of texts.

CT2505 Understanding Two cultures: Science (Technology) and Society [3:0:3]
Science that began by discovering regularities existing in irregular nature has remarkably changed our society in combination with the technology of the past 2,500 years. Thanks to science and technology, mankind now enjoys more abundant and convenient lives than ever but, at the same time, we are faced with global issues that we did not foresee, including climate change, shortage of water, depletion of energy, shortage of food and new diseases. Through historical, philosophical and cultural approaches on science and technology, students will think about and discuss the direction of science and technology in the future society to come.

CT4101 Ideas and Digital Expressions [1:4:3]
This course aims to have students analyze the goals and phenomena of given assignments, and based on the results of these analyses, perform infinite imagination and understand basic principles within a virtual digital environment. The course visualizes the above procedures digitally so that
everyone can relate to the understanding.

CT4201 Computer Graphics [3:0:3]
This course teaches students the basic principles of computer graphics that are essentially utilized in various fields of culture industries including films, games, AR and VR. Students will study the graphics pipeline, transformation, shading, rasterization, ray tracing, global illumination, etc., all of which are employed to produce high-quality images from virtual three-dimensional models.

CT4301 Human-Computer Interaction [3:0:3]
This course provides a summary and introduction of the field of Human-Computer Interaction (HCI). The course provides students with overviews of the concept of people-oriented computing, detailed research areas of HCI (for instance, mobile HCI/UI/UX, wearable computing, tangible interface, Human-Robot Interaction, sensor-based context-understanding technology, AI-based interaction design, etc.), recent research trends and domestic and overseas research groups. This course is open to undergraduates and unofficial graduate school-level students within the major.

CT4302 Designing Artificial Intelligence for Culture Technology Applications [3:0:3]
Artificial intelligence technology, which has been getting a lot of attention in recent years, is utilized to develop autonomous artificial life and apply them to various applied areas of games and digital art. For this, students of the course will study AI technology, which includes artificial life technology, evolution technology and action network, to design an intelligence and behavior pattern of artificial life, and design and materialize the games and digital art platform for the development and evaluation of autonomous intelligence and behavior models.

CT4504 Scientific Programming [3:0:3]
In this course, students will first learn basic programming languages (C, C++ language, etc.). Students will then learn the fundamentals of scientific programming through the environment for scientific computing and a few real cases including the basic understanding of UNIX OS and visualization, which are for high-performance computing needed to execute computational science.

CT4506 Monte Carlo Methods and Their Applications [3:0:3]
This course is an intensive course of the subject of scientific computing, and studies the fundamentals of (dynamic) Monte Carlo Methods needed in the nano age as well as the applications of Monte Carlo scientific research through the characteristics of such methods and several actual cases.

F. Intelligent Robotics minor

1) Overview

Intelligent robots, which recognize the external environment, make judgments of a situation on their own and operate autonomously, are fused with artificial intelligence, mechatronics, human interface technology. These robots continue to expand their scope of application into healthcare robots, intelligent unmanned automation, and robots specialized in national defense, medicine, maritime and the environment. By providing GIST students to minor in this program for the development of integrated talents specializing in the field of intelligent robots, the school aims to offer more opportunities to encounter diversity in integrated research.

2) Overview of courses

IR3201 Kinematics and Dynamics [2:2:3]
Kinematics and Dynamics is a study that can answer such questions as how the motion of all moving objects (displacement, velocity, acceleration) is expressed and how an object will react once an external force is exerted on it. Once the fundamental principles of dynamics are understood, students will be able to comprehend the motions of automobiles, airplanes, humans and animals and, based on this, a system may be designed and controlled. This course explains the basic principles of dynamics in particles and rigid bodies and also examines the relationship among work, energy, impact and momentum. The fundamental principles can be experienced through various experiments and simulations.

IR3202 Electromechanical System Modeling [3:0:3]
In this course, students learn about the modeling technique using bond graphs in order to understand mathematically explained system dynamics from the standpoint of interconversion of energy or power. The universal modeling technique, which enables understanding of various physical systems including mechanical, hydraulic, electrical, electronic and magnetic systems via a single graphic modeling technique, will be introduced. Through this, students will be asked to understand not only the method of inducing dynamic relationships of a system but also design stability and instability. The primary objective of the course is to raise the level of intuition for the mathematical and physical understanding of actuators, sensors and plants using the principle of electromagnetism, which is the most popularly utilized in mechatronics.

IR3203 Microprocessor and Embedded Systems [2:2:3]
This course comprises of three parts. In the first part, students will learn about the basic structure of microprocessors (ARM processor), registers, memory, cache and input and output operations as well as how to operate processors using basic assembly languages. The second part will study how to use ARM-based microprocessors and processors through exercises. Lastly, students participating in the lectures will execute projects through the realization of embedded systems such as mobile robots based on ARM processors. The executed projects will be evaluated after public demonstrations around the midterms and final exams.

IR4201 Deep Learning [3:0:3]
In this course, students without prior knowledge will study the fundamental mathematical tools as well as the artificial neural network, multilayer perceptron, back propagation algorithm and deep convolutional neural network, and also apply them to linear regression analyses and classifier learning.

IR4202 Mechatronics [2:2:3]
This course aims to cultivate the ability to design mechanical systems through the convergence of machines and electronic engineering by an integrated approach featuring Labview-based design and experiments. The contents of the lectures include hardware interface, digital and analog interface, measurement and sensing, activation of electronic devices, and control systems of mechatronics systems for the realization of graphic-based real-time mechatronics systems.

IR4203 Human-Computer Interaction [3:0:3]
This course provides a summary and introduction of the field of Human-Computer Interaction (HCI). The course provides students with overviews of the concept of people-oriented computing, detailed research areas of HCI (for instance, mobile HCI/UI/UX, wearable computing, tangible interface, Human-Robot Interaction, sensor-based context-understanding technology, AI-based interaction design, etc.), recent research trends and domestic and overseas research groups. This course is open to undergraduates and unofficial graduate school-level students within the major.

IR4204 Law of Artificial Intelligence and Robots [3:0:3]
This course deals with legal controversies surrounding robotics technology, which is arguably the most advanced form of scientific technology. The first part of the course will summarize the legal issues for each category of application (medical, military and social robots, autonomous driving cars, etc.) of AI robotics technology and the latter part of the course will carry out more itemized discussions on various legal issues (for example, constitutional status of robots, responsibility of robots' behaviors for civil damage compensation cases, crimes and penal responsibility, etc.).

IR4205 Robotics [2:2:3]
This course introduces the overall theories needed in robotics as well as technologies such as actuators, design, sensors, dynamics, control, AI and navigation. With a goal to provide students with a general view on robotics, the course looks at robot mechanisms and also related assistive technology (for example, sensing and actuators for robots and robot intelligence utilizing AI, etc.). The course primarily utilizes ROS (robot OS), a software framework for robot development, and also allows students to develop various applications that use 6-axis robot arms.

IR4206 Design of Creative Robotic Convergence Systems based on Artificial Intelligence [1:4:3]
This course aims to realize customized creative innovation education based on AI and robotics technology to foster talents who can lead the era of the Fourth Industrial Revolution. Thus, the course systematically trains students through the Design Thinking Process from planning to production to not only achieve convergence of robotic engineering, AI and digital technology but also develop their understanding and creative thinking ability on various technologies and thought expression skills.

IR4207 Automatic Control [3:0:3]
Automatic Control is the first subject to take among the control theory courses, and primarily deals with the analysis and design of the continuous-time control system. Lectures will especially examine the Laplace transform, modeling of systems, analyses of initial and stable responses, the root-locus analysis and subsequent control system design, frequency response analysis and subsequent control system design. Through this course, students will learn simple but useful methods to design dynamic system controllers such as autonomous driving vehicles, unmanned aircraft and robots.

IR4208 Robotics and Kinematics [3:0:3]
This course aims to promote kinematics and the motion creation technology of simple four-bar linkage, articulated robots, mobile robots, mobile manipulators and humanoid robots. Thus, based on the mechanism analyses of the closed-loop four-bar linkage and six-bar linkage of 1-degree-of-freedom and the five-bar linkage of 2-degree-of-freedom, the course implements motion analyses of multi-degree-of-freedom rigid body motion, velocity analysis and static analysis, and also lectures on AI-based, intelligent motion creation technology for the application of various robots to the field.

Undergraduate Student Research Program

1. G-SURF

A. Major details

G-SURF is a summer research program which is benchmarked against Caltech's SURF (Summer Undergraduate Research Fellowship). GIST College provides opportunities for selected junior and senior undergraduate students. These students are assigned to graduate school labs where they conduct research for eight weeks during the summer break under the guidance of academic advisers.

B. Purpose of implementation

1) To provide students enrolled in the undergraduate curriculum the opportunity to gain research experience prior to graduation

2) To practice applying the principles and knowledge of general sciences into actual research (cultivating creativity and problem-solving ability) and experience lab life under the mentorship of academic advisers, thus enabling students to acquire the qualifications demanded from researchers (cultivating the ability to communicate and experience teamwork)

C. Measures of implementation

1) Payment of research scholarships
- July: GIST College provides KRW 300,000
- August: The laboratory provides another KRW 300,000 (When the research advising professor desides after assessment

2) Four weeks following the start of participation in G-SURF, the academic adviser conducts an intermediate assessment and will decide whether to continue the research depending on the results of the assessment

D. Requirements

1) Submission of research plan and research results report
2) Mandatory participation in the Poster Session
3) Commute to and from the lab according to the guidance of the academic adviser

E. Program promotion schedule and details

Details will be announced on the website. Starting from May.

Actual program starts from June to August. (8weeks)

2. Caltech SURF study abroad students

A. Major details

1) A maximum of two students from GIST and Caltech are exchanged for 10 weeks starting from mid-June to carry out projects under the guidance of academic advisers and perform oral presentations at the end of the program
2) $6,350 in scholarships are provided to each of the selected students (to be utilized for tuition, flight fee, dormitory, meals, health insurance, visa issuance, etc. and any remaining fees to be paid by the student)

B. Qualifications to apply

1) Proficiency in English required to carry out a project with an academic adviser of Caltech, write a report and orally present the results
※ TOEFL IBT 110 or higher required
2) Capabilities in general sciences and concentration enabling the student to choose a project topic and carry out research
3) Sense of responsibility to follow the relevant guidelines of GIST College and Caltech and fulfill the given duties
4) Students enrolled in their junior or senior year of undergraduate programs

C. Selection criteria

1) GPA in all semesters completed
2) Proficiency in English (official English exam scores and interview)
3) Essay (intent and plan of studies)
4) Volunteer service records, leadership skills and other activities considered
5) Talents who fit the desired student character of GIST College (3C 1P) in addition to the other quantitative indices

D. Promotion schedule and process

Details will be announced on the GIST website. Starting from January.

Global Talent Fostering Program

1. GIST-Caltech exchange and cooperation

Category	Details
Study Abroad Program (Fall)	- Select and dispatch GIST students in their junior or senior year with specific qualifications to Caltech's fall regular term ※ 6 GIST students in total dispatched between 2014 and 2019 - Administrative support: KRW 25 million in scholarship provided per student by GIST College (to be used as tuition, housing, flight fee, etc.) ※ Due to the high cost of expenses in the region, students are advised to prepare their own personal funds to cover additional costs - Qualifications to apply: Students enrolled in their junior or senior year in the specific year (min. 4 or more semesters registered), GPA of 3.7 or higher in semesters completed, IBT 110 or higher - Selection criteria: GPA during the enrollment, proficiency in English (official English exam scores and interview), application and essay, volunteer service records, leadership skills and other activities, talents who fit the desired student character of GIST College (3C 1P) in addition to the quantitative indices

※ Details will be announced on the GIST website. Starting from January

2. GIST-UC Berkeley exchange and cooperation

Category	Details
UC Berkeley Summer Session	- Dispatch students to UC Berkeley for the summer session (Session C) for 8 weeks to take 2 regular courses (6-8 units) - Select and dispatch students in their sophomore and junior year who possess the official English score (TOEIC 785 or higher) as demanded by UC Berkeley ※ 876 GIST students in total dispatched between 2010 and 2019, the process of selecting students to be dispatched in 2021 in progress
Study Abroad Program (Spring)	- Dispatch selected GIST students in their junior or senior year with specific qualifications to the spring semester ※ 51 GIST students in total dispatched between 2013 and 2019 - Administrative support: KRW 25 million in scholarship provided per student of GIST College (to be used as tuition, housing, flight fee, etc.) ※ Students may need to spend personal spent - Qualifications to apply: Students enrolled in their junior or senior year in the specific year (min. 4 or more semesters registered), GPA of 3.5 or higher in semesters completed, IBT 90 or higher - Selection criteria: GPA during the enrollment, proficiency in English (official English exam scores and interview), application and essay, volunteer service records, leadership skills and other activities, talents who fit the desired student character of GIST College (3C 1P) in addition to the quantitative indices

※ Details will be announced on the GIST website. Starting from January(Summer) and September(for next SAP).

3. Summer semester programs at foreign universities including UC Berkeley

Category	Details
Boston University Summer Term	- Dispatching to Boston University for 6 weeks during the summer break to enroll in 2 regular courses (8 units)
Cambridge Summer Program	- Dispatching students to Cambridge University to complete courses in 2 areas for 3 weeks from professors at Cambridge University
Technion - Israel Institute of Technology	- Dispatching students interested in startups to E&I (Entrepreneurship & Innovation), startup education program conducted at the International School of Technion - Israel Institute of Technology - $6,000 provided per student including tuition, room and board for 5 weeks during the summer break

※ Details can be found on the GIST website. Starting from January.

4. Other international exchange and cooperation programs

Category	Details
GIST-UNU Internship Programs	- Participating in internship programs operated by UNU-INWEH (United Nations University - Institute for Water, Environment and Health, Canada) and UNU-FLORES (United Nations University-Integrated Management of Material Fluxes and of Resources, Germany) (research programs in water quality-related environmental issues, water resource tmanagement and soil usage and management in developing countries) - Completion certificates issued after completing a 6- to 8-week program during summer and winter breaks - Training expenses provided (amount of expenses determined based on the selection results) ※ Supervising department: International Institute for Environment

5. Common items for GIST College study-abroad programs

A. In principle, students must depart and arrive as a group according to the pre-defined schedule.

B. In principle, when selecting candidates for the study-abroad program, dual benefits should be excluded to the greatest extent possible.

C. If anything unusual occurs to the student him/herself or to a colleague, it must immediately be notified to the leader, local representatives and the school to take proper measures.

D. A copy of the pledge, in which the student vows not to commit any action that either threatens the safety of self and/or his or her colleagues for the duration of the overseas stay, or damage the reputation and class of our school, must be signed prior to the dispatch and submitted to the Section of Undergraduate Administration Services.

[Appendix 1] General academics

1. Allocation of credits and grade assessments

A. Allocation of credits

1) The unit of completion of courses is credit, and credits are divided into “curricular credits” and “research credits.” Curricular credits are classified into 1 credit, 2 credits, 3 credits and 4 credits depending on the importance of courses and the number of classes. 1 credit is assigned for a semester-long course held one hour per week or for any equivalent number of hours. However, for experiments and exercises, 1 credit is assigned for a semester-long course held two hours per week or for any equivalent number of hours. Among liberal arts subjects, <Basics of Language> courses including English, Writing are an exception; 2 credits are assigned for these semester-long courses held three hours per week.

B. Grade assessments

1) Academic grades are assessed by responsible professors of the course by considering exam scores, attendance, research reports, study attitude, among other factors.
2) The grades and points of academic performances are as follows:

Grade	A^+	A^0	B^+	B^0	C^+	C^0	D^+	D^0	F	Pass (S)	Fail (U)	Incomplete (Inc)
Point	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0	0	(C^+ or higher)		

3) GPA is calculated by the method of arithmetic mean and cut to the nearest thousandth. However, “S” is included in the completed credits but not included when calculating the GPA.
4) Courses for which a request for cancellation of enrollment has been submitted are shown as W and not included when calculating the GPA.
5) Those who are unable to take an exam due to military service, illness and other unavoidable reason should submit a request for an additional exam with evidential documents prior to the exam, and obtain the approval of the president. The additional exam must be taken prior to the first day of the following semester.

C. Acceptance of credits

1) Even for courses that a student does not take, he or she may acquire credits through credit recognition exams. The criteria to pass a credit recognition exam is B level or higher and, in such a case, the grade level will be assigned according to the aforementioned criteria.
2) Credits acquired at other universities may be accepted by the approval of the president after receiving a recommendation from an academic adviser or a related faculty member and a request from the head of the department for courses corresponding to GIST College curricula only. Up to 30 of such credits may be accepted. Also, the accepted credits are included in the graduation completion credits but will be excluded when calculating the GPA.
3) Credits acquired at other universities or graduate schools in Korea or overseas, either accepted by the president or for which an agreement for credit exchange is signed during the enrollment in the undergraduate program, will display the grades acquired but will not be included when calculating the GPA.

4) A student in an undergraduate program may acquire credits from graduate school-level subjects and include them in the undergraduate program graduation (completion) credits, and the remaining portion of the credits excluding the already included credits may be included in the graduation (completion) credits after enrolling in the graduate school program only if the grades are C or higher. However, they will be excluded when calculating the GPA.
5) If an undergraduate student wishes to use a break to enroll in a seasonal semester at a university overseas, he or she must undergo a review by the responsible professor of the comparable course at GIST College in advance and submit a short-term study-abroad application.
6) If a student in any program completes a prerequisite course after entering the particular program, the credits will not be included in the number of credits required for the acquisition of a degree.
7) Acceptance of credits in double-coded courses: Even for cases in which a double-coded course is both a major and a minor, its credits will be accepted only for a desired area (cannot be accepted as both)
   ※ Same criteria applies to cases in which the double-coded course is completed in a semester prior to its designation as a double-coded course
8) Credits taken (completed) in a seasonal semester immediately preceding graduation are not accepted as graduation completion credits.
   ※ Example: Credits completed in the 2019 winter semester by a student scheduled to graduate in February 2020 are not accepted as graduation completion credits

D. Graduates with honors

For expected graduates from undergraduate programs with outstanding academic performance and good conduct during enrollment, the president commends upon graduation the following and records it in the school register and on the diploma. However, those who have been disciplined during enrollment are excluded from the targets of commendation.

Category	GPA
Summa cum laude	4.3 or higher
Magna cum laude	Between 4.1 and 4.3
Cum laude	Between 3.9 and 4.1

E. Academic probation

Academic probation is placed on students, whose GPA of the immediately preceding semester is below 2.0/4.5, prior to the first day of the following semester. However, those who have taken seasonal semesters are excluded. Students who receive three academic probations during the undergraduate program will be expelled.

2. Leave of absence, reinstatement, voluntary withdrawal, re-entrance and prohibition of double enrollment

A. Leave of absence (Article 46 of the School Regulations)

1) In the case of a student from each course cannot take a class due to a disease, accident, military service, pregnancy, childbirth, infant care (only for a child below 8 years old or grade 2 at the elementary school), business startup, or other unavoidable reasons, the student shall submit a permission for leave of absence through the academic advisor and the department head to get the President's approval. However, according to the GIST's

policy, in the case of studying at another domestic or foreign university for a paper research, the student cannot take a leave of absence.

2) The period of the leave of absence in total shall not exceed 2 semesters for the graduate course, 4 semesters for the bachelor's degree and doctor's degree courses, and 6 semesters for the integrated courses. However, the leave of absence due to military service, pregnancy, childbirth and infant care shall not be included in the above period, but the leave of absence due to pregnancy, childbirth and infant care shall only be allowed for 4 semesters per child. Despite of the period of leave of absence by course from above (hereinafter referred to as "general leave of absence"), the leave of absence for business startup shall be allowed to take a leave of absence for additional 4 semesters, and with an extension of additional 4 semesters after going through the deliberation of the Academic Affairs Committee. During such period, the sum of the period of general leave of absence and the period of leave of absence for business startup shall not exceed a total of 8 semesters.
3) When giving approval to expel a student, including a student of each course dropping out of school, the President shall ask for the repayment of the whole or parts of the students education expenses (hereinafter referred to as "beneficiary expenses") from the applicable student who received such education at the GIST while in school. However, it may be exempted by taking into consideration of the circumstances.
4) A student who has submitted an application for leave of absence and obtained permission thereof during the registration period may be exempted from payments for the semester.
5) A student who is still not reinstated after passing of the period under Paragraph (3) shall be expelled.

B. Reinstatement (Article 47 of the School Regulations)

1) When a student on leave of absence intends to be reinstated, he/she must submit an application for reinstatement and obtain permission from the president following approvals from his/her academic advisor and the head of the unit he/she belongs to.
2) The reinstatement period shall be during the registration period at the beginning of a semester: Provided, that reinstatement may be allowed in the middle of a semester in case a student who has taken leave of absence due to military service or after completing registration for a semester intends to be reinstated during the semester for termination of the reason for leave of absence.

C. Voluntary Withdrawal (Article 48 of the School Regulations)

1) Students of each program cannot arbitrarily withdraw without a legitimate reason: Provided, that a student who wishes to voluntarily withdraw for an unavoidable reason must submit an application for voluntary withdrawal and obtain permission from the president following the approvals from his/her academic advisor and the head of the unit he/she belongs to.
2) When allowing an expulsion such as a voluntary withdrawal etc. of a student from a master's or doctoral program, the president shall have the student repay all or part of the educational expenses he/she has received while in GIST (hereinafter referred to as "benefits received in educational expenses"): Provided, that the repayment may be waived under certain circumstances.
3) Matters concerning the repayment of benefits received in educational expenses pursuant to Paragraph (2) shall be separately prescribed by the president following deliberations of the Academic and Student Affairs Committee.

D. Re-entrance (Article 49 of the School Regulations)

1) In the case of a person who has dropped out or been expelled from the school wishes to be readmitted within two years, the person may be readmitted to the year he/she went to before being dropped out or expelled or below after going through the deliberation and resolution of the Academic Affairs Committee during the registration period for admission at the beginning of the term. However, a person who has been expelled due to the expiration of period of attendance at school, academic warning, failure in a qualifying exam, and disciplinary action cannot be readmitted.
2) Re-entrance is limited to one time.
3) The president may recognize the credits already acquired by a re-entered student after hearing the opinions of his/her academic advisor and the head of the unit he/she belongs to.
4) The enrollment period of a re-entered student shall be calculated from the date of his/her first entrance into each program of GIST.

E. Prohibition of Double Enrollment (Article 50 of the School Regulations)

Students in each program are prohibited from double enrollment: Provided, that students in joint degree programs under agreements with foreign partner universities are exempt.

3. Award Bestowment and Disciplinary Action

A. Award (Article 51 of the School Regulations)

The president may bestow an award on a GIST student who is well-behaved and falls under any of the subparagraphs below, following deliberations of the Academic and Student Affairs Committee:

1) A person who has demonstrated outstanding creativity;
2) A person who has achieved outstanding academic marks;
3) A person who has shown good conduct deemed worthy of citation.

B. Academic probation (Article 52 of the School Regulations)

1) The president shall place under academic probation the students of each program whose academic records during enrollment are poor, to help boost their academic enthusiasm and improve their academic records: Provided, that in case such a student is in his/her last semester before graduation and meets the degree completion requirements, such action may be omitted in consideration of his/her overall academic achievements and the number of courses he/she is taking in the semester.
2) The president may impose restrictions on the number of course credits taken, extracurricular activities, etc. for students of each program who have been placed under academic probation.
3) A student who is placed under academic probation two times while enrolled in a master's or a doctoral program or a student who is placed under academic probation three times while enrolled in a bachelor's program shall be expelled.
4) When the president places a student under academic probation or expels a student, he/she must immediately notify such action to the student's academic advisor and the head of the unit the student belongs to.

C. Disciplinary punishment and Categories (Articles 53 of the School Regulations)

In the case of falling under one of the following items, the President shall listen to the opinions of the academic advisor and the department head to take immediate disciplinary action after going through the deliberation and resolution of the Academic Affairs Committee:

1) A student who has shown extremely poor conduct and is deemed impenitent;

2) A student who has shown poor academic achievements and is deemed incapable of completing the program;
3) A student who has been frequently absent without a legitimate reason;
4) A student who has disrupted class by unapproved group activity or committed an act that seriously harms the academic atmosphere on campus;
5) A student who has committed an act on or off campus that seriously errs from the path of duty of a student and is deemed to have defamed the reputation of GIST or caused damages to GIST;
6) A student who has committed an act of gaining unauthorized access to, altering, damaging, or leaking information or interfering with the normal operation of information systems on or off campus;
7) A students who has committed others acts that violate the academic regulations.

D. Categories of Disciplinary Action (Articles 54 of the School Regulations)

Disciplinary action shall be classified into probation, suspension, and expulsion.

Types of rewards

Category	Qualification criteria	Remark
Admission rewards	Students with outstanding grades among admitted freshmen	
Graduation rewards	Graduates with outstanding grades accumulated during enrollment (Summa cum laude, Magna cum laude and Cum laude)	
Special rewards	Students with outstanding research achievements during enrollment, students who have made special contributions	

Types of disciplinary punishment

Causes of punishment \ Punishment policy	Light punishment		Severe punishment	
	Probation (Less than 1 month)	Limited suspension (1 to 6 months	Indefinite suspension (More than 7 months)	Expulsion
1. Related to conduct				
A. Assault (injuries)	○	○	○	○
	Light	Medium	Serious	Very serious
B. Verbal abuse (threats)	○	○	○	
	Light	Medium	Serious	
C. Sexual assault (sexual harassment, sexual molestation, rape, etc.)		○	○	○
		Light	Medium	Serious
D. Actions breaching public order	○	○	○	
	Light	Medium	Serious	
E. Forgery and falsification of documents	○	○	○	○
	Light	Medium	Serious	Very serious
F. Violation of regulations and guidelines of organization	○	○	○	
	Light	Medium	Serious	
G. Defamation of honor of organization and faculty by various misdeeds	○	○	○	
	Light	Medium	Serious	
H. Defamation of honor of organization and faculty through publications (posts)		○	○	○
		Light	Medium	Serious
I. Unauthorized absence	○	○	○	○
	5 consecutive days	10 consecutive days	20 consecutive days	30 consecutive days
J. Unauthorized profit-making activities	○	○	○	
	Light	Medium	Serious	
K. Forgery of signature of academic adviser or responsible professor		○	○	○
		Light	Medium	Serious
L. Unlawful criminal activities including theft		○	○	○
		By case	By case	By case
2. Related to academics and research				
A. Fabrication of exam scores and leakage of exam questions		○	○	○
		Light	Medium	Serious
B. Illegal activities during exam	○	○	○	○
	Light	Medium	Serious	Very serious
C. Interruption in class	○	○	○	
	Light	Medium	Serious	
D. Academic probation*				○
* Certain expulsion to which Article 7's re-screening does not apply				3 times in undergraduate, 2 times in graduate
E. Violation of research ethics*		○	○	○
* Detailed conditions follow Article 3 of the operation guidelines of the Research Integrity Committee		Light	Medium	Serious
3. Other items				
A. Unauthorized browsing, damage, leakage and/or hacking of the information system	○	○	○	○
	Light	Medium	Serious	Very serious
B. Unauthorized usage or damage of facility and educational tools*	○	○		
* Additional civil compensation	Fault	Intention		
C. Unauthorized leakage of school assets to the outside*	○	○	○	
* Additional civil compensation	KRW 1 mil. ↓	KRW 1 mil. ↑	KRW 5 mil. ↑	
D. Other reasons for punishment recognized by the Academic Committee	○	○	○	○

1. The determination of Light, Medium, Serious and Very serious punishments will be judged by the Academic Committee, and repeat offenders may be additionally punished.
2. For cases of 1-A, 1-B and 1-C, specified counseling and education will be received at GIST Counseling & Career Development Center.
3. For the case of 1-J, punishment will be applied separately based on the measures specified in Article 5 (Repayment of benefit expenses) and Article 6 (Limitation of tuition) of the Student Extracurricular Activity Guidelines
4. For the cases of 2-A and 2-B, the grades of the particular courses will be given as F

[Appendix Table 1]

Qualifications to declare a major

Category	Qualifications for major declaration	Remark
Starting from t he entering class of 2018	Those who have registered for 2 or more regular semesters or acquired 30 or more credits in total	- The 2 regular semesters do not include seasonal semesters - The 30 credits include those recognized in accordance with Article 39 of the School Regulations (Credits obtained from other universities can potentially be acknowledged)
The entering class of 2010 through 2017	Those who have registered for 4 or more regular semesters or acquired 60 or more credits in total	- The 4 regular semesters do not include seasonal semesters - The 60 credits include those recognized in accordance with Article 39 of the School Regulations (Credits obtained from other universities can potentially be acknowledged)
	Those who have completed concentr ation prerequisites defined for each concentration	- Those who have not completed concentration prerequisites may enter the major as well but, upon entering the major, students must prioritze completing the concentration prerequisites.

[Appendix Table 2]

Qualifications to declare a minor

Category	Qualifications to declare a minor	Remark
Starting from the entering Class of 2018	Those having completed 2 or more regular semesters	Both requirements must be met
	Those whose GPA is 2.5 or higher	
The entering Class of 2010 through 2017	Those having completed 4 or more regular semesters	Both requirements must be met
	Those whose GPA is 2.5 or higher	

[Appendix Table 3]

Restriction on credits accepted for major concentration graduation

Category	Min. number of credits by concentration	Max. number of credits accepted by concentration
Starting from the entering Class of 2018	36 30 for Materials Science and Engineering	42
The entering Class of 2010 through 2017	30	36

[Appendix 2] Introducing GIST College House (dormitory)

1. Housing system

A. Overview

The housing system is a dormitory system being implemented at various universities abroad i n which a number of small-scale residential communities are formed within dormitories to link students' studies and lives together. By operating the first residential college-style housing system in Korea, GIST College has gained positive outcomes in undergraduate students' dormitory life as well as their university lives as a whole.

B. Constitution

1) Comprises four houses in total (G, I, S and T House)
2) One housemaster, who oversees the house management, and one academic adviser per house to help students
3) One house manager per house is appointed to plan and operate programs by house and manage the house life
4) Expected effects
   - Increased sense of belonging and pride for GIST College
   - Establishment of unique cultures in each house through different cultural and academic activities
   - More interactions and exchanges between professors and students as well as between older and younger students

2. House entry and exit procedure

A. Entry procedure: Submit application for entry (online) ⇒ Application Review and allocation of room ⇒ Entry

B. Exit procedure: Submit application for exit ⇒ Verification and inspection of cleaning conditions of room ⇒ Permission of exit

C. Other inquiries on usage
(T.3641/E-mail: kuyunmi99@gist.ac.kr), house manager(janitor)'s room (T.5800)

3. Relevant regulations

A. College dormitory operation guidelines
B. College dormitory living regulations
C. College dormitory inspection standard
D. College dormitory internal facility usage standard

4. Principles of entry into dormitory

A. Entry into the dormitory is limited to students enrolled at GIST College and up until the 4th year (8th semester) of the undergraduate program
However, entry may be restricted depending on the capacity of the dormitory

B. Students who have exceeded the aforementioned requirements may be admitted additionally by the approval of the house operating committee

C. The permitted period of entry into the dormitory will be semester based

D. Any vacated room over the course of a semester may temporarily house school employees, researchers, interns, etc.

E. Those who have postponed graduation cannot live in the house starting from January 2018
※ Postponement of graduation: Intentionally deciding not to submit the final printed thesis to the library for the purpose of not graduating even though the necessary conditions for graduation including a dissertation have been met

5. Caution

A. The following products are prohibited from usage for dormitory safety.

Category	Heating equipment	Cooking equipment	Audio equipment		Electrical equipment	Other products
Item	Electric blanket, electric pad, fan heater	Burner, cooker, coffee pot, toaster, microwave	Audio equipment	Video TV, audio	Fan, hairdryer, computer, refrigerator (1 below 100 ℓ in each room)	Electric cord
Possible for usage	Impossible	Impossible	Possible	Possible	Possible	Form-approved item

B. If a product not written above is to be used, permission from the operation and management team must be obtained. The permitted types of items among electrical goods can only be used after obtaining permission of usage from the housemaster, and all faulty electric cords (non-KS products, products without any electricity marking or products with two exposed wires) must be collected.

C. The use of old electrical goods whose optimum period of stable usage has expired is prohibited.

D. Always pay attention to the safety of electrical goods to strive for the prevention of fire.

※ Detailed facilities in of each “house“

▣ Building A

1. Building status
   A. 1 underground floor, 6 above-ground floors
   B. 228 dormitory rooms (2 people per room, 24 of the rooms may be switched to 3-person rooms depending on the demand), 45 common rooms
   C. Summary by floor

Category	Area (㎡)	Details
B1 floor	270.83	Mechanical room, electrical room, club room
1st floor	1,831.89	Dormitory room (general 37, handicapped 1), housemaster’s room, snack bar, laundry room (male/female/common), cleaning service room, mailbox room
2nd floor	1,831.88	Dormitory room (general 37, handicapped 1), fitness training room (2), community room, housemaster’s room, student lounge, club room (7), discussion room, student council room, storage
3rd floor	1,709.17	Dormitory room (38), data processing machine room, reading room (2), student lounge (2), computer room, storage, lounge deck (3)
4th floor	1,116.16	Dormitory room (38), lounge deck (2), cleaning equipment room (2)
5th floor	1,024.17	Dormitory room (38), lounge deck (2), cleaning equipment room (2)
6th floor	1,024.17	Dormitory room (38), cleaning equipment room (2)
Total	**8,808.27**	**Dormitory room (general 226, handicapped 2)**

2. Equipment
   A. Dormitory room: bed, bookshelf, desk, mobile drawer, chair, built-in closet, shoe rack
   B. Common room: housemaster’s room (desk, drawer, chair, cabinet), lounge (sofa, etc.)
   C. Various equipment: heater and air conditioner, TV, washing machine, computer, water purifier and heater, weight training equipment, amp, etc.
   D. Outdoor facilities: bicycle rack, recycling stand, etc.

3. Other facilities
   A. Number of parking spaces: 68
   B. Elevators: 24-person capacity, 2 elevators

▣ Building B

1. Building status
   A. 1 underground floor, 6 above ground floors
   B. 217 dormitory rooms (2 people per room), 21 common rooms
   C. Summary by floor

Category	Area (㎡)	Details
B1 floor	471.71	Mechanical room, electrical room, service agent room, instrument practice room
1st floor	1,316.64	Dormitory room (22), Haedong digital library, meeting room, snack bar, mailbox room
2nd floor	1,737.20	Dormitory room (40), meeting room, laundry room (male/female), club rooms (2)
3rd floor	1,559.28	Dormitory room (40), meeting room, reading room, storage
4th floor	1,363..23	Dormitory room (39), storage
5th floor	1,349,11	Dormitory room (38), storage
6th floor	1,349,11	Dormitory room (38), storage
Total	**9,146.28**	**Dormitory room (217)**

2. Equipment
   A. Dormitory room: bed, bookshelf, desk, mobile drawer, chair, built-in closet, shoe rack
   B. Common room: table, chair, etc.
   C. Various equipment: heater and air conditioner, TV, washing machine, water purifier and heater, amp, etc.
   D. Outdoor facilities: bicycle rack, recycling stand, etc.

3. Other facilities
   A. Number of parking spaces: 47
   B. Elevators: 24-person capacity, 2 elevators