Double Degree Master Program Information and Application Guide

Since the ultimate goal to establish the AUN-KU-NAIST Excellence Program of Advanced Materials Technology for Sustainable ASEAN Development (AUN-KU-NAIST Mat-E) consortium is to create the double degree program between Kasetsart University and Nara Institute of Science and Technology, the information about curriculum to conduct joint education has been outlined.

The double degree program in the first phase, with the duration between 2022 and 2025, is aimed at providing the educational opportunities for Thai, Japanese, and ASEAN students.

Double Degree Program between Department of Materials Engineering, Kasetsart University and Division of Materials Science, Nara Institute of Science and Technology

Objective of the program:

With continual collaborations in summer internship program between the Department of Materials Engineering, Kasetsart University (MatE-KU) and Division of Materials Science, Nara institute of Science and Technology (NAIST), and in recognition of the value of enhanced student–faculty mobility, the Department of Materials Engineering, KU and Division of Materials Science, NAIST, have decided to initiate a double degree program involving Master of Engineering in Materials Engineering and Master of Science in Materials Science.

In addition to the benefit in terms of student–faculty mobility, the double degree program also serves as a bridge to strengthen international cooperation, both in academic and research. The program also aims at promoting internationalization of higher education and delivering international skills as well as innovative learning experiences to students who participate in the program.

Language of instruction:

English

Prospective participants:

- Thai students who received a Bachelor of Engineering Degree from the Department of Materials Engineering, Kasetsart University.
- Thai students who received a Bachelor of Science or Bachelor of Engineering Degree.
- Japanese students who received a Bachelor of Science or Bachelor of Engineering in Materials Science or related fields.
- Thai and ASEAN students who received a Bachelor of Science or Bachelor of Engineering Degree in materials science, physics, chemistry, metallurgical engineering, chemical engineering, or other related fields.

Curricular Plan
Academic Program: KU–NAIST Double Degree

The study plan of the KU–NAIST double degree program in Master of Engineering/Master of Science comprises six semesters with courses and master thesis. Students take residential credits at both institutions according to the following plan:

Year 1: First semester (11 credits)

Classes taken at KU

01213512	Materials Technology and Trends	1 credit
01213513	Thermodynamics and Kinetics of Materials	3 credits
01213591	Research Methods in Materials Engineering	3 credits

Elective:

01213555 Semiconductor Materials and Devices	1 credit
01213557 Optoelectronics	1 credit
01213556 Atomic Structure of Solids and Surfaces	1 credit

Equivalent Transfer Credits (From KU to NAIST)

○ 3038 Semiconductor Materials	1 credit
○ 3035 Optoelectronics	1 credit
○ 4066 Electronic Properties and Atomic Structure of Solid and Surfaces Special	1 credit

Year 1: Second semester (9 credits)

Classes taken at KU

01213514	Materials Characterization in Research	3 credits
01213599	Thesis	2 credits
01213597	Seminar I	1 credit

Elective:

01213542 Organic Materials Synthesis	1 credit
01213543 Polymer Chemistry	1 credit
01213558 Photonics	1 credit

Equivalent Transfer Credits (From KU to NAIST)

○ 6008 Seminar I	2 credits
○ 3036 Organic synthesis and Polymer Science	1 credit
○ 4073 Polymer Chemistry	1 credit
○ 4067 Photonics special	1 credit

Year 2: First semester (4 credits)

Classes taken at KU

01213599	Thesis	4 credits
01213597	Seminar II	1 credit

Total **24 credits**

Year 2: Second semester – Year 3: Second Semester

Classes taken at NAIST

General Subjects — ***4 credit***

- 1001 Technology and Professional Ethics — 1 credit

Select 1 credit from following subjects

- 1004 Intellectual Property Right — 1 credit
- 1019 Exercise for Intellectual Property Right — 1 credit
- 1016 Japanese Culture — 2 credit

Select 2 credits from following subjects (1 credit each)

- 1012 Academic Discussion — 1 credit
- 1013 Research Presentation — 1 credit
- 1014 Research Writing — 1 credit
- 1015 Advanced Research Writing — 1 credit

Introduction Subjects — ***1 credits***

- 2005 Introduction to Materials Sci. and Eng. — 1 credit

PBL Subjects — ***2 credits***

- 5009 Materials Science and Engineering PBL I — 1 credit
- 5010 Materials Science and Engineering PBL II — 1 credit

Required Elective Subjects (Basic Subjects) — ***3 credits***

Select 2 credits from

- 3022 Quantum Mechanics — 1 credit
- 3023 Core Quantum Mechanics II — 1 credit

OR

- 3024 Core Physical Chemistry I — 1 credit
- 3025 Physical Chemistry — 1 credit

And Select 1 more credit from

- 3037 Biomaterials Chemistry — 1 credit

Elective Subjects (Specialized Subjects) — ***3 credits***

Select 3 credits from

- 4070 Biomolecular Science — 1 credit
- 4072 Molecular Photo-Science — 1 credit
- 4115 Organometallic Chemistry — 1 credit
- 4076 Materials Science Special A — 1 credit
- 4077 Materials Science Special B — 1 credit

Select 1 credit from Basic Subjects or Specialized Subjects

- XXXX — 1 credit — ***1 credit***

Research Activities Subjects — ***8 credits***

- 6009 Seminar II — 2 credits
- 6010 Research Thesis — 6 credits

Total — **22 credits**

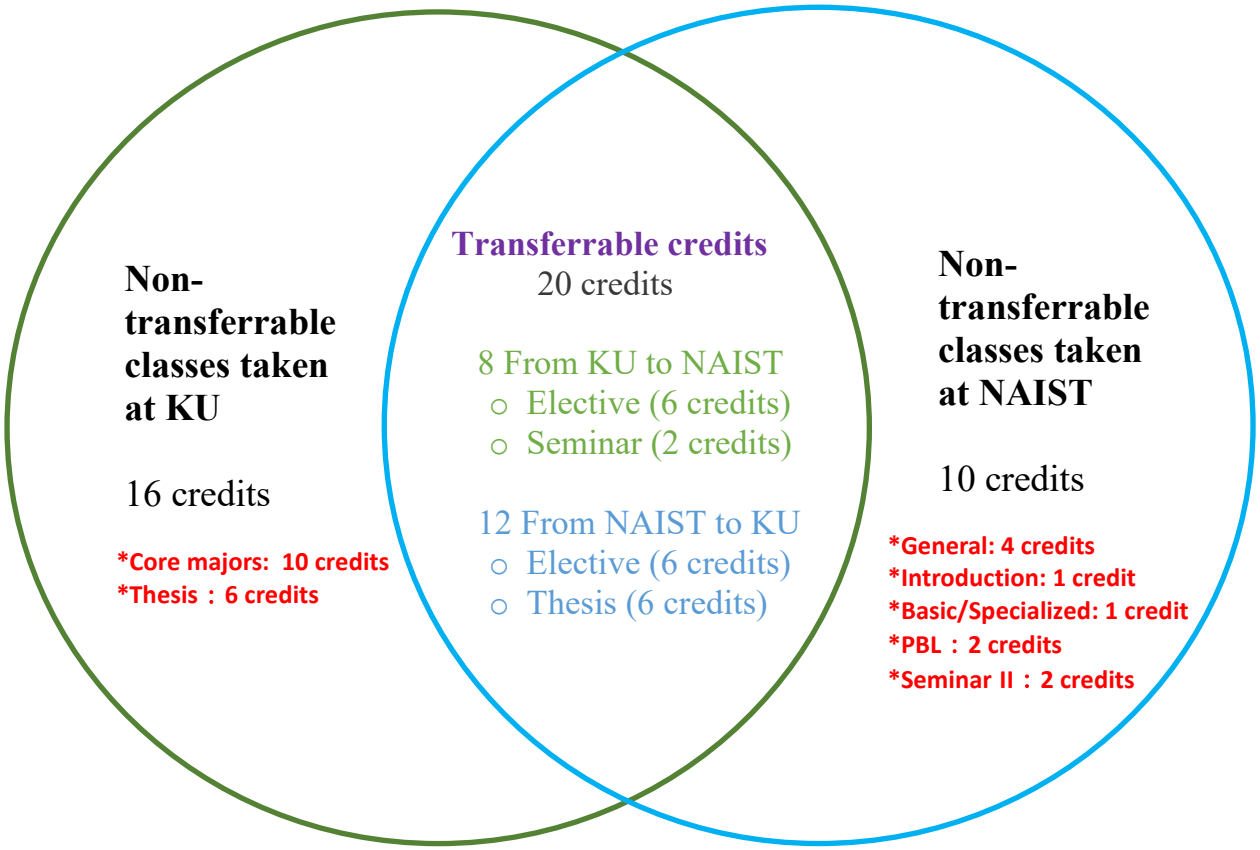
Transfer Credits (From NAIST to KU)

Required Elective Subjects (Basic Subjects)	3 credits
Elective Subjects (Specialized Subjects)	3 credits
6010 Research Thesis	6 credits
Total	**12 credits**

Summary of Double Degree Program Credits

Total number of credits from each institution:

KU	24 credits [16 (non-transferable) + 8 (transfer from KU to NAIST)]
NAIST	22 credits [10 (non-transferable) +12 (transfer from NAIST to KU)]
Total	**46 credits**



*Please refer to NAIST-KU Curriculum chart correspondence Table supplementary for more details.

Curriculum Details

Kasetsart University (KU)

Degree: Master of Engineering (Materials Engineering)
M.Eng. (Materials Engineering)

Curriculum Structure:

The degree of Master of Engineering (Materials Engineering) consists of a minimum of 36 credits, including 12 credits of master thesis and at least 24 credits of major taught courses.

1. Minimum of 24 credits of major taught courses composing of
   - 1.1 2 credits of seminar
   - 1.2 10 credits of core major courses
     - 01213512 Materials Technology and Trends 1 credit
     - 01213513 Thermodynamics and Kinetics of Materials 3 credits
     - 01213514 Materials Characterization in Research 3 credits
     - 01213591 Research Methods in Materials Engineering 3 credits
   - 1.3 12 credits of elective major courses
2. Minimum of 12 credits in a master thesis

Nara Institute of Science and Technology (NAIST)

Degree: Master's (science) or Master's (engineering)

Curriculum Structure:

The degree of Master of Science or Master of Engineering consists of a minimum of 30 credits, according to the following Table:

Subject Category		**Number of credits required for completion**
Courses	**Category**	
General Subjects		4
Science and Technology Subjects	Introduction Subjects	14
	Basic Subjects	
	Specialized Subjects	
	PBL Subjects	2
Research-based Subjects		10
Total		30

Course List: Kasetsart University

1. Minimum of 24 credits of major taught courses

1.1	**2 credits of seminar**	
01213597	Seminar	1 credit
1.2	**10 credits of core major courses**	
01213512	Materials Technology and Trends	1 credit
01213513	Thermodynamics and Kinetics of Materials	3 credits
01213514	Materials Characterization in Research	3 credits
01213591	Research Methods in Materials Engineering	3 credits
1.3	**12 credits of elective major courses**	
01213524	Corrosion Failure Analysis and Prevention	3 credits
01213528	Fatigue and Surface Optimization	3 credits
01213529	Advanced Mechanical Behavior of Materials	3 credits
01213531	Bioceramics	3 credits
01213532	Advanced Electroceramic Materials	3 credits
01213533	Crystallography of Materials	3 credits
01213534	Materials for High Temperature Applications	3 credits
01213542	Organic Materials Synthesis	1 credit
01213543	Polymer Chemistry	1 credit
01213545	Polymer Physics	3 credits
01213546	Inorganic and Organometallic Polymers	3 credits
01213547	Properties of Polymers	3 credits
01213548	Degradation of polymer	3 credits
01213549	Biopolymers	3 credits
01213551	Advanced Composite Materials	3 credits
01213552	Nanoengineering	3 credits
01213555	Semiconductor Materials and Devices	1 credit
01213556	Atomic Structure of Solids and Surfaces	1 credit
01213557	Optoelectronics	1 credit
01213558	Photonics	1 credit
01213564	Materials Processing and Application	3 credits
01213566	Advanced Ceramics Processing	3 credits
01213567	Advanced Polymer Processing and Rheology	3 credits
01213569	Electrochemical Engineering for Industrial Materials and Waste Management	3 credits
01213571	Computer-Aided Engineering Analysis for Materials Engineering	3 credits
01213572	Materials Processing and Production Engineering	3 credits
01213573	Product Design for Engineering Applications	3 credits
01213596	Selected Topics in Materials Engineering	1–3 credits
01213598	Special Problems	1–3 credits

2. Minimum of 12 credits in a master thesis

01213599	Thesis	1–12 credits

Course Description

01213512 Materials Technology and Trends **(1 credit)**

Advancements in material technology. Materials for renewable energy and energy storage. Semiconductor materials. Materials contributing to carbon neutrality. Smart materials. Materials for medical applications. Materials technology management. Data analysis. Relevant laws and standards.

01213513 **Thermodynamics and Kinetics of Materials (3 credits)**

Classical and statistical thermodynamics. Equilibrium state and phase diagrams. Behavior of gases and solutions. Chemical reaction. Free energy. Empirical kinetics. Kinetics of ideal systems. Non-isothermal reactions. Thermal analysis techniques. Crystallization. Transport phenomena of materials. Case study.

01213514 **Materials Characterization in Research (3 credits)**

Principle of x-ray diffractometry. Applications of x-ray diffractometry in research. Hands-on practice in x-ray diffractometer operation. Principle of scanning electron microscope. Applications of scanning electron microscope in research. Qualitative and quantitative chemical analysis by energy dispersive spectroscopy. Hands-on practice in scanning electron microscope operation. Principle of transmission electron microscope. Sample preparation for transmission electron microscope. Principle of electron diffractometry. Structural analysis of materials by electron diffractometry.

01213524 **Corrosion Failure Analysis and Prevention (3 credits)**

Principles of corrosion. Forms and mechanisms of corrosion. Corrosion prevention by cathodic protection and coatings. Materials selection and design. Corrosion testing methods. Corrosion failure analysis.

01213527 **Alloy Technology (3 credits)**

Development of alloy technology. Production of ferrous and non-ferrous metals. Ferrous and non-ferrous alloys. Development and application of modern alloys. Amorphous alloys. Nanocrystalline alloys. Alloys in industrial applications. Alloy design.

01213528 **Fatigue and Surface Optimization (3 credits)**

Fatigue of metals. Fatigue failure mechanism. Crack initiation and propagation. Effect of residual stresses. Surface treatments for fatigue prevention.

01213529 **Advanced Mechanical Behavior of Materials (3 credits)**

Mechanical properties and testing. Stress and strain analysis. Fracture and fracture mechanics. Applications of metals and their failure. Case study.

01213531 **Bioceramics** **(3 credits)**

Characteristics and properties of bioceramics. Biocompatibility with human bodies. Applications of bioceramics in medicine and dentistry. Case study.

01213532 **Advanced Electroceramic Materials** **(3 credits)**

Physical and chemical principles of ceramic conductors. Dielectric ceramics and ceramic superconductors. Relationship among structure, processing, microstructure and electrical properties of ceramics. Synthesis and forming processes of electroceramic materials. Applications of electroceramic materials.

01213533 **Crystallography of Materials** **(3 credits)**

Crystal structures concepts. Crystal structures classifying. Symmetry in crystal structures. Relationships between crystal structures and mechanical, electrical, optical, and magnetic properties of materials.

01213534 **Materials for High Temperature Applications** **(3 credits)**

Selections of materials for high temperature applications. Mechanical and physical behaviors of refractory metal and alloys. Ceramics and ceramic matrix composites in refractory technology. Thermal barrier coatings in space vehicles and satellites.

01213535 **High-Performance Materials for Nuclear and Electric Engine Applications** **(3 credits)**

Study the principles of selecting and designing high-performance materials for advanced nuclear energy systems and electric vehicles, with an emphasis on ceramic materials and inorganic compounds that exhibit high thermal resistance, mechanical strength, corrosion resistance, and durability under extreme environments. Topics include applications in nuclear fuel and cladding materials, radiation shielding, structural components, and electrically conductive materials used in electric drive systems. The course also covers safety and reliability standards for materials in large-scale engineering systems, while fostering integrative analytical.

01213542 **Organic Materials Synthesis** **(1 credits)**

Organic materials synthesis. Structure and reactivity of aromatic compounds. Basic polymer synthesis. Anionic, cationic, and radical polymerization. Case studies.

01213543 **Polymer Chemistry** **(1 credits)**

History of polymer science. Synthetic polymers. Synthetic polymerization reaction. Analytical methods for polymer characterization. Control of polymer structures. Case Studies

01213545 **Polymer Physics** **(3 credits)**

Polymer molecules. Ideal polymer states. Chain statistics and rheology of polymer solutions and melts. Rubber-like elasticity. Transition to glassy state. Hard amorphous polymers. Polymer crystals. Morphology and thermomechanical responses of partially crystalline polymers.

01213546 **Inorganic and Organometallic Polymers** **(3 credits)**

Mechanisms of polymerization and characterizations of inorganic and organometallic polymers.

01213547 **Properties of Polymers** **(3 credits)**

Single chain property. Solution property. Solid-state property. Mechanical property. Viscoelastic property. Optical property. Thermal property. Electrical property.

01213548 **Degradation of Polymer** **(3 credits)**

Degradation of polymer by heat, light, oxidation, high energy radiation, photo-oxidation, mechanical force, microorganism, and special environment.

01213549 **Biopolymers** **(3 credits)**

Structure of biopolymers. Application of characterization techniques. X-ray structural analysis. Bio plastic. Biomedical polymer. Bionanotechnology.

01213551 **Advanced Composite Materials** **(3 credits)**

The interface between matrix and dispersed phase. Fabrication of composites. Mechanical and thermal properties of composites. Design of composite materials. Applications and case study.

01213552 **Nanoengineering** **(3 credits)**

Definition, history and advances in nano-scale science and engineering. Characterization techniques and properties of nano-scale materials. Production processes, applications and examples of nano-scale devices, emphasizing the relationship between structures, properties and applications.

01213553 **Advanced Biomaterials** **(3 credits)**

Classification and applications of biomaterials. Characterization of biomaterials. Relationships of structure and property of biomaterials. Biocompatibility and toxicity. Biodegradable materials. Design and production. Soft tissue and hard tissue implants.

01213555 **Semiconductor Materials and Devices** **(1 credits)**

Physical and electronic properties of semiconductors. Properties of various junction interfaces. Principle of semiconductor device operation. Microfabrication technology. Case Studies.

01213556 **Atomic Structure of Solids and Surfaces** **(1 credits)**

Reciprocal lattice and diffraction phenomena. Interaction between photons, electrons, and atoms. Surface properties. Magnetic interactions. Modification of surface microstructures. Surface measurements and analysis.

01213557 **Optoelectronics** **(1 credits)**

Wave optics. Optoelectronic properties of materials. Interaction between light waves and materials. Optical device physics. Mechanisms and applications of optical devices.

01213558 **Photonics** **(1 credits)**

Physics of luminescent phenomena. Indirect radiation detection. Semiconductor photosensor. Photonic devices. Scintillators. Dosimeter.

01213562 **Advanced Transport Phenomena and Numerical Techniques (3 credits)**

Viscosity and the mechanism of momentum transport. Shell momentum balance. The equation of continuity and the equation of motion. Dimensional analysis. Thermal conductivity. Shell energy balances. Heat conduction in a complex shape. Temperature distribution with more than one variable. Fick's law and shell mass balances. Diffusion-reaction equation. Finite difference method. Concepts of optimization. Multiphysics modeling.

01213564 **Materials Processing and Application (3 credits)**

Recent advancements in materials processing. Phase transformation for materials processing. Materials processing for production, advanced Materials, nanomaterials, organic Materials. Materials processing applications. Case studies.

01213565 **Advanced Metal Processing (3 credits)**

Advanced thermodynamics and phase diagrams. Advanced diffusion and kinetics of phase transformation. Crystal interfaces and interfacial energy. Defects in solids. Nucleation and growth. Alloy solidification. Castings and welding. Diffusional phase transformations in solids. Precipitate growth and age hardening. Diffusionless transformations and martensitic transformation. Interphase mass transfer. Oxide surface formation.

01213566 **Advanced Ceramics Processing (3 credits)**

Ceramic powder synthesis techniques by comminution, solid state reaction, combustion synthesis, co-precipitation and spray drying. Characterization of ceramic powder. Ceramic fabrication techniques by pressing and injection molding. Principle of slurry preparation and particle interaction. Preparation of ceramic samples from slurry. Thin film preparation. Preparation of single crystal materials for research and industrial applications. Modern technology in sample preparation. Characterization of ceramic samples.

01213567 **Advanced Polymer Processing and Rheology (3 credits)**

Principle and applications of rheology and measurement. Special injection molding processes. Co-extrusion and related processes. Compression molding processes. Vacuum forming processes. Transport phenomena in polymer processing. Case study. Basic principle of computer-aided-engineering technology in polymer processing.

01213568 **Microelectronic and Microsystem Technology and Fabrications (3 credits)**

Overview of microelectronic technology. Materials technology for microelectronic applications. Microelectronic devices. Crystal growth. Diffusion and transport phenomena for microfabrication. Thermal oxidation. Impurity doping and ion implantation. Lithography and etching. Physical deposition and chemical vapor deposition. Fundamentals and mechanisms of microsystem and microelectromechanical systems (MEMS). Materials for microsystem and MEMS. Micromanufacturing and surface micromachining.

01213569 **Electrochemical Engineering for Industrial materials and Waste Management (3 credits)**

Principles of electrochemistry and transport processes. Batteries and fuel-cells. Sensors. Electrowinning and refining of metals. Surface modification by electro/electroless deposition and etching. Metal waste recycling. Electrochemical instrumentations.

01213571 **Computer-Aided Engineering Analysis for Materials Engineering (3 credits)**

Principles and applications of computational engineering analysis. Computer-aided engineering for mechanical applications. Computer-aided engineering for thermal applications. Computer-aided engineering for electrochemical applications. Computer-aided engineering for electromagnet applications. Case studies.

01213572 **Materials Processing and Production Engineering (3 credits)**

Materials engineering for process and product engineers. Process planning strategies. Productivity enhancement. Process improvement methodologies. Quality control. Cost analysis. Risk management. Project management. Materials testing compliance with industry standards. Engineering standards and regulations in production. Data analytics and digital tools for decision making and process control.

01213573 Product Design for Engineering Applications and Materials Selection (3 credits)

Product Design and Development. Materials Selection for Engineering Design. Finite Element Method and Simulation for Engineering Design. Mechanical and Thermal Properties. Materials Selection in Mechanical Product Design. Materials Selection in Thermal Product Design. Electronic Materials and Properties. Materials Selection in Electronic Product Design. Magnetic Materials and Applications. Chemical and Electrochemical Properties. Chemical and Electrochemical Applications. Process-Based Cost Model.

01213591 **Research Methods in Materials Engineering (3 credits)**

Principles and research methods in materials engineering, problem analysis for research topic identification, data collection for research planning, identification of samples and techniques. Analysis, interpretation and discussion of research result; report writing for presentation and publication.

01213596 **Selected Topics in Materials Engineering (1–3 credits)**

Selected topics in materials engineering at the master's degree level. Topics are subject to change each semester.

01213597 **Seminar (1 credit)**

Presentation and discussion on current interesting topics in materials engineering at the master's degree level.

01213598 **Special Problems** **(1–3 credits)**
Study and research in materials engineering at the master's degree level and compile into a written report.

01213599 **Thesis** **(1–12 credits)**
Research in the master's degree level and compile into a written report.

Definition of course numbering for Master of Engineering at KU

The definition of the eight (8) digits in each course number is as follows:

Digits 1-2	(01)	Bang Khen campus
Digits 3-5	(213)	Materials Engineering subjects
Digit 6		Level of study (1-4 for Undergraduate, 5 for Masters, 6 for PhD)
Digit 7		Subject category
		1 Materials Engineering foundation subjects
		2 Metals
		3 Ceramics
		4 Polymers
		5 Applied and advanced materials
		6 Manufacturing processing
		7 Materials Engineering innovation design and development
		9 Research, Seminar, Advanced topics, Selected problems, Thesis
Digit 8		Order within each category

e.g. 01213524
(01-213-5-22) Bang Khen–Materials Engineering–Masters level–Metals–subject #2

Course List: Nara Institute of Science and Technology

Subject type	Category	Subject name	Subject Number	Number of credits	Number of credits required for completion		Registration Category Education Programs
					Thesis Research/ Specialized Project Research	Project Report	Materials Science and Engineering
General Subjects	-	Technology and Professional Ethics	1001	1	4	4	◎
		Philosophy of Science	1002	1			○
		Science Communication	1003	1			○
		Intellectual Property Right	1004	1			○
		Exercise for Intellectual Property Rights	1019	1			○
		Professional CommunicationI	1010	1			□
		Professional CommunicationII	1011	1			□
		Academic Discussion	1012	1			□
		Research Presentation	1013	1			□
		Research Writing	1014	1			□
		Advanced Research Writing	1015	1			□
		Intercultural Communication	1034	1			□
		Japanese Culture	1016	2			○
Science and Technology Subjects	Introduction Subjects	Introduction to Information Science and Engineering	2001	1	at least 14 credits from the Introduction, basic and specialized subjects required for each educational program	at least 16 credits from the Introduction, basic and specialized subjects required for each educational program	○
		Introduction to Biological Science	2003	1			○
		Introduction to Materials Science and Engineering	2005	1			◎
	Basic Subjects	Mathematical Analyses for Materials Science	3021	1			○
		Quantum Mechanics	3022	1			□C
		Core Quantum Mechanics II	3023	1			□C
		Core Physical Chemistry I	3024	1			□C
		Physical Chemistry	3025	1			□C
		Core Solid State Physics I	3026	1			○
		Core Solid State Physics II	3027	1			○
		Core Molecular Science I	3028	1			○
		Core Molecular Science II	3029	1			○
		Biomaterials Chemistry	3037	1			○
		Semiconductor Materials	3038	1			○
		Optoelectronics	3035	1			□C
		Organic Synthesis and Polymer Science	3036	1			□C
		Fundamentals of Data Science	3039	1			○
		Advanced Digital Technologies	3040	1			○
		Human Body Structure, Function and Diseases	3041	1			○
		Applying Chemistry to Society	3042	1			○
		Cell Biology by the number	3043	1			○
		Programming for Digital Green Technology	3044	1			○
		Data Processing for Digital Green Technology	3045	1			○

Science and Technology Subjects	Specialized Subjects	Fundamentals of innovation	4118	1	at least 14 credits from the Introduction, basic and specialized subjects required for each educational program	at least 16 credits from the Introduction, basic and specialized subjects required for each educational program	○
		Advanced lecture on creation of innovation I	4119	1			○
		Advanced lecture on creation of innovation II	4120	1			○
		Advanced lecture on creation of innovation III	4121	1			○
		Advanced lecture on creation of innovation IV	4122	1			○
		Advanced lecture on creation of innovation V	4123	1			○
		Co-creation of Global Innovation	4124	1			○
		Development of Bioscience into Industry	4125	1			○
		Bioimaging	4126	1			○
		Electronic Properties and Atomic Structures of Solids and Surfaces Special	4066	1			○
		Light and Information Devices Special	4068	1			○
		Biomolecular Science	4070	1			○
Science and Technology Subjects	Specialized Subjects	Molecular Photo-science	4072	1	at least 14 credits from the Introduction, basic and specialized subjects required for each educational program	at least 16 credits from the Introduction, basic and specialized subjects required for each educational program	○
		Photonics Special	4067	1			○
		Materials Science for Quantum Information and Energy Conversion	4069	1			○
		Organometallic Chemistry	4115	1			○
		Polymer Chemistry	4073	1			○
		Materials Informatics	4074	1			○
		Materials Science Special A	4076	1			○
		Materials Science Special B	4077	1			○
		Materials Science Special C	4078	1			○
		Materials Science Special D	4079	1			○
		Materials Science Special E	4127	1			○
		Project Practice	4083	1			○
	PBL Subjec	Materials Science and Engineering PBLI	5009	1	2	2	◎
		Materials Science and Engineering PBLII	5010	1			◎
Research-based Subjects	-	SeminarI	6008	2	10	8	◎
		SeminarII	6009	2			◎
		Thesis Research	6010	6			□
		Specialized Project Research	6011	6			□
		Project Report	6012	4			□
Number of credits required for completion					30	30	
In the “Required/elective” column, ◎, □, and ○ represent required subjects, required elective subjects, and elective subjects, respectively. Subjects marked △ do not count as credits toward the completion							

*for more information, please refer to the NAIST e-syllabus system
https://syllabus.naist.jp/subjects/preview_list

NAIST Registration requirements

A. (i) When taking “Thesis Research” or “Specialized Project Research”, a total of 30 credits or more must be completed, including at least four credits from General Subjects, at least 14 credits among Introduction Subjects, Basic Subjects and Specialized Subjects, at least two credits from PBL Subjects, and at least ten credits from Research-based Subjects.

(ii) When taking “Project Report”, the total of 30 credits or more must be completed, including at least four credits from General Subjects, at least 16 credits among Introduction Subjects, Basic Subjects and Specialized Subjects, and at least two credits from PBL Subjects, and at least eight credits from Research-based Subjects.

B. Basic Subjects and Specialized Subjects mentioned in A above must include the completion of Core Subjects defined as course completion requirements for each educational program.

For the Program of Materials Science and Engineering, at least two subjects as described below must be completed.

A combination of either Quantum Mechanics and Core Quantum MechanicsII or of Core Physical ChemistryI and Physical Chemistry.

Numbering Information

Subject numbers consist of 4-digit numbers based on levels of courses.

First digit：First digit in the 6-digit numbers indicates levels of subjects:

1XXX = General Subjects（For master’s course）

2XXX = Introduction Subjects（For master’s course）

3XXX = Basic Subjects（For master’s course）

4XXX = Specialized Subjects（For master’s course）

SXXX = PBL Subjects（For master’s course）

6XXX = Research-based Subjects（For master’s course）

From second to fourth digits：The from second to fourth digits in the 4-digit numbers indicate serial

X**XXX** = Serial numbers (ranging from 01 to 99)

Coursework Performance Evaluation at KU

The coursework performance evaluation is based on the syllabus of each course, set up by respective instructors to ensure that the students fulfill the objectives of the course. The student's coursework performance is assessed based on the grade scaling and distribution explained in the course syllabus, given and explained to the students at the beginning of each course by the instructor.

The grade-level structure is as following:

Grade Level	Definition	Grade Point
A	Excellent	4.0
B+	Very good	3.5
B	Good	3.0
C+	Fairly good	2.5
C	Fair	2.0
D+	Poor	1.5
D	Very poor	1.0
F	Fail	0.0
I	Incomplete	-
S	Satisfactory	-
U	Unsatisfactory	-
P	Passed	-
N	Grade not yet reported	-

Coursework Performance Evaluation at NAIST

The GPA [Grade Point Average] system

In order to promote the internationalization of future education and increase the transparency of the grading system, NAIST has introduced a GPA system beginning with the students who entered in the 2018 academic year.

<System Overview >

The GPA system is a common method used in European and American universities to evaluate academic grades. Students receive grade evaluations after course completion, and it is converted into Grade Points (GP) with the student's overall average computed as a single value.

<Calculation Method >

There are five levels of Grade Points (S, A, B, C, D) as shown below.

Definition and Letter Grade	GP	Evaluation Criteria	Criteria out of 100 points
Excellent (S)	4	Achieved learning outcomes with exceptionally high grade	90 points or more
Very good (A)	3	Achieved learning outcomes with high grade.	80 points or more
Good (B)	2	Achieved learning outcomes with good grade.	70 points or more
Fair (C)	1	Achieved learning outcomes.	60 points or more
Fail (D)	0	Did not achieve learning outcomes.	less than 60 points

(For Reference)

Definition and Letter Grade	GP	Evaluation Criteria	Criteria out of 100 points
Accredited (N)	Not Applicable	Considered as completed as studied in an academic course at this university.	Not Applicable
Pass (P)	Not Applicable	Reached the academic level for this course.	Not Applicable
Fail (F)	Not Applicable	Did not reach the academic level of this course.	Not Applicable

<Targeted Students >

The students who begin the Master's Course in the 2018 academic year and all subsequent years.

<Targeted Subjects >

All subjects that count towards completion of the Master's Course in the subject categories shown below. However, if a subject cannot be evaluated by the five-level grading scheme due to the nature of the subject, it will be excluded from the GPA calculation.

◇ General Subjects
◇ Basic Subjects
◇ Specialized Subjects

<Types of GPAs and Calculation Method >

There is a GPA for the academic year (annual GPA) and a GPA for the entire program (cumulative GPA).

Here are the calculation methods for annual and cumulative GPAs. (Round off to two decimal digits in calculating a GPA.)

□ Calculation of an Annual GPA

Annual GPA = The sum for all subjects of (the number of credits for a registered subject for the year x GP of the subject)/The total number of credits for the year's subjects.

□ Calculation of Cumulative GPA

Cumulative GPA= The sum for all subjects of (the number of credits for a registered subject for the program x GP of the subject)/The total number of credits for the program.

<How to Treat Retake Subjects >

If a student retakes a subject which he/she has failed and receives a passing grade or another failed grade as a result, the earlier result and credits are excluded from GPA. (The data before the retake will be excluded.)

<Treatment on Academic Record >

Both the annual GPA and the cumulative GPA will appear on the academic record.

<Guidelines concerning the Distribution of Academic Performance Evaluations>

1. For the grading scale consisting of S, A, B, and C, particular attention must be paid to prevent the uneven distribution of academic performance evaluations. Especially concerning S and A evaluations, together they should comprise roughly 30% of the evaluations.
2. If there are 20 or less registered students for a course or that the course academic evaluations wil1 be determined on a pass or fail grading scale, these guidelines sha11 not be applicable.

Requirements for awarding of the double degree

To be awarded the double degree, students must successfully fulfill all the requirements of **both** Materials Engineering Program at Kasetsart University (KU) and Materials Science Program at Nara Institute of Science and Technology (NAIST).

To receive a Master of Engineering Degree in Materials Engineering from Kasetsart University, all the following requirements must be met:

• Acquire a minimum of 36 academic credits
• Maintain at least a 3.0 GPA (Grade Point Average) on the scale of 4.0
• Satisfy enrollment residence requirement: at least two of the semesters must be taken at Kasetsart University
• Satisfy language requirement: this can be achieved by one of the following

- Pass the English test administrated by the Faculty of Humanity, Kasetsart University
- Enroll in the 01355501 course and obtain an S grade
- Receive a standardized test score in the following levels:

	Minimum score
TOEFL	450 (paper-based)
	133 (computer based)
	45 (internet-based)
IELTS	5.0
CU-TEP	45
KU-EPT	50%
KU-TOEFL-ITP	450

• Complete a Thesis work and successfully defend the Thesis work
• Satisfy publication requirement: this can be achieved by one of the following

-Publication, or at least approval for publication of thesis, or parts thereof, in acceptable national or international journals as announced by the Office of the Higher Education Commission on "The Criteria of Academic Journal for Publication Consideration".

OR

-Presentation of thesis in an academic conference which issues full version proceedings in the conference.

To receive a degree of Master of Science or Master of Engineering from Nara institute of Science and Technology, the following conditions must be satisfied:

Students must be registered in the Master's Course for at least two years, and complete at least 30 credits (including successfully completing "Research Ethics Training Session"). These credits must include at least 4 credits from "General Subjects," at least 2 credits from introductory subjects in "Science and Technology Subjects," at least 12 credits from the basic and specialized subjects required for their Education Program, at least 2 credits from PBL subjects offered by their Education Program, and at least 10 credits from "Research-based Subjects". In addition, students must receive necessary research guidance, submit and successfully defend their master's thesis, and pass the final exam.

[Program of Materials Science and Engineering]

For the Program of Materials Science and Engineering, at least four subjects in (i) and (ii) must be completed.

(i) A set of Core Subjects of either a combination of "Core Solid State Physics I" and "Core Solid State Physics II" or a combination of "Core Molecular Science I" and "Core Molecular Science II".

(ii) At least two Core Subjects must be completed from among "Biomaterials Chemistry", "Semiconductor Materials", "Optoelectronics" and "Organic Synthesis and Polymer Science".

Thesis Examination

Language: All submitted written materials and viva voce examinations will be in English.

Joint Thesis Proposal Examination (KU) and Mid-Term Report (NAIST)

Students are required to give an oral presentation of their thesis prior to their final thesis defense examination. This presentation is referred to as "Thesis Proposal" and "Mid-Term Report" by KU and NAIST, respectively. For the Double Degree Program this presentation will be jointly held with attendance of the thesis supervisors of both institutions, either in person or via teleconferencing (e.g. Skype), and research progress will be evaluated based on a shared rubric.

Additional requirements are as follows:

For KU, students are required to submit their "Thesis Proposal" to the Graduate School of Kasetsart University before the end of their 4th regular semester since their initial registration and at least 3 months (90 days) before their final thesis defense examination.

For NAIST, students are required to give an oral presentation of their "thesis mid-term report" and submit abstract of their presentation by settled due date.

Thesis Defense Examination

The members of the joint dissertation committee shall be selected under the regulations of both institutions. The dissertation committee will prepare a review report countersigned by all members of the dissertation committee.

For KU, the thesis examination committee must consist of:

- Chair of dissertation committee appointed by The Graduate School (KU),
- Thesis supervisor(s)
- Co-supervisor (if any)
- External examiner

For NAIST, the thesis examination committee must consist of:

At least three faculty members of the Graduate School of Science and Technology and the shared educational and research institutions. In this case the committee members shall include at least two professors, or one professor and one associate professor recognized by the Faculty Council.

Two copies of a dissertation for both the host and home institutions written in English will be submitted. Format of the dissertation should follow the guidelines defined by the home institution. The student will also be required to submit an abstract written in English. Following appropriate responses to the critiques raised by the committee in the dissertation, the student will then be allowed to perform a dissertation defense.