Introduction to Engineering Physics (2.0credits) (物理工学のすすめ)

Course Type	Basic Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	Materials Physics
Starts 1	1 Spring Semester	1 Spring Semester
Lecturer	Associated Faculty	Associated Faculty

●Course Purpose
Students learn fundamental issues and research activities in the departments of Applied Physics and Materials Physics.

●Prerequisite Subjects
it is desired to have have basic knowledge of physics such as mechanics, electromagnetism, statistical mechanics, and quantum mechanics.

●Course Topics
(1)Research contents of Department of Applied Physics and related basic contents
(2)Research contents of Department of Materials Science and related basic contents

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and terms related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

g and Discussion on Applied Physics（Solid State Engineering） A (2.0credits) (応用物理学特別輪講（物性基礎工

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study the physical phenomena in condensed matter physics from a microscopic point of view, students read suitable textbooks and learn theoretical methods on electronic properties (magnetism, semiconductors, superconductors), cold atomic systems (Bose-Einstein condensation, Fermi superfluids), and topological materials.

Purposes:

1. Students are able to perform calculations on theoretical problems on quantum many-body problems.
2. Students understand and can explain several phenomena of electron properties in solids, and superconductivity/superfluidity.

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4

●Course Topics

Read a textbook on recent topics of superconductivity, superfluidity and topological materials. Students read the textbook before the class and give a presentation. All students should read the textbook before the class and actively join the discussion.

●Textbook

Textbooks will be selected at the beginning of the semester.

●Additional Reading

"superconductivity", J. B. Ketterson and S. N, Song, Cambridge University Press

●Grade Assessment

Oral presentations and discussions.

●Notes

Basic knowledge of Quantum physics, statistical physics, and solid-state physics are required.

●Contacting Faculty

At each seminar.

g and Discussion on Applied Physics（Solid State Engineering） B (2.0credits) (応用物理学特別輪講（物性基礎工

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study the physical phenomena in condensed matter physics from a microscopic point of view, students read suitable textbooks and learn theoretical methods on electronic properties (magnetism, semiconductors, superconductors), cold atomic systems (Bose-Einstein condensation, Fermi superfluids), and topological materials.

Purposes:

1. Students are able to perform calculations on theoretical problems on quantum many-body problems.
2. Students understand and can explain several phenomena of electron properties in solids, and superconductivity/superfluidity.

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4, Reading and Discussion on Applied Physics (Solid State Engineering) A, Seminar on Solid State Engineering 1A

●Course Topics

Read a textbook on recent topics of superconductivity, superfluidity and topological materials. Students read the textbook before the class and give a presentation. All students should read the textbook before the class and actively join the discussion.

●Textbook

Textbooks will be selected at the beginning of the semester.

●Additional Reading

"superconductivity", J. B. Ketterson and S. N, Song, Cambridge University Press

●Grade Assessment

Oral presentations and discussions.

●Notes

Basic knowledge of Quantum physics, statistical physics, and solid-state physics are required.

●Contacting Faculty

At each seminar.

d Discussion on Applied Physics （Optical Science and Engineering）A (2.0credits) (応用物理学特別輪講（光物

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Students read and explain the content of a text on condensed matter physics to acquire fundamentals for understanding on frontier researches. They make discussions throughout the class and communicate with each other based on the physical thinking to acquire applied skills for their own researches.

●Prerequisite Subjects

1. Quantum Mechanics
2. Solid State Physics

●Course Topics

Explanation on the content of the text in turn, and discussion.

●Textbook

We choose a text at the beginning of a new fiscal year.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Explanation on the content of the text and discussion. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

Students can ask questions in and after the class. Otherwise, contact the instructors.

d Discussion on Applied Physics （Optical Science and Engineering）B (2.0credits) (応用物理学特別輪講（光物

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Students read and explain the content of a text on condensed matter physics to acquire fundamentals for understanding on frontier researches. They make discussions throughout the class and communicate with each other based on the physical thinking to acquire applied skills for their own researches.

●Prerequisite Subjects

1. Quantum Mechanics
2. Solid State Physics

●Course Topics

Explanation on the content of the text in turn, and discussion.

●Textbook

We choose a text at the beginning of a new fiscal year.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Explanation on the content of the text and discussion. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

Students can ask questions in and after the class. Otherwise, contact the instructors.

scussion on Applied Physics （Quantum Physics in Condensed Matter）A (2.0credits) (応用物理学特別輪講（量

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on original papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices2. Ion-driven novel functional devices3. Valleytronics based on atomically thin materials4. Electron spin resonance study of structure and property of organic solids 5. Electrical conduction and superconductivity of organic solids.Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the lecture.

scussion on Applied Physics （Quantum Physics in Condensed Matter）B (2.0credits) (応用物理学特別輪講（量

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on original papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices2. Ion-driven novel functional devices3. Valleytronics based on atomically thin materials4. Electron spin resonance study of structure and property of organic solids 5. Electrical conduction and superconductivity of organic solids.Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the lecture.

ssion on Applied Physics （Structural Materials Science and Engineering）A (2.0credits) (応用物理学特別輪講

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Circle form	
Course Name	Applied Physics	
Starts 1	1 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

In the lecture on structural Physics, 1. Recognizing the importance of studying the structure of materials, 2. Understanding traditional methods of structural analysis, 3. To deepen the understanding of practical methods of structural study methods such as X-ray diffraction method, 4. We study related books by participants for the purpose of learning recent experiment method or recent analysis method. Select books for each year. We will deepen discussion and understanding by solving exercises etc on our own.

●Prerequisite Subjects

Solid state physics, quantum mechanics, statistical mechanics etc.

●Course Topics

The purpose of the present course is to obtain the basic knowledge for studying the structural physics. In the classes, we will perform below,1. Reading the textbook and discussions. Students read and explain the contents of the textbook in turn, and perform the discussion after that. 2. Soving the questions relating to the textbook. Students are required to acquire the knowledge completely.In order to enhance the class effect, it is necessary to prepare in advance and review after the class.

●Textbook

TBD

●Additional Reading

Introduction to Solid State Physics by C. Kittel,Synchrotron Radiation Crystallography by P.Coppens, X-ray Diffraction by B.E. Warren,

●Grade Assessment

Evaluate the target achievement level by question-and-answer at the time of presentation. Pass score of 60 points or more with 100 full marks.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

ssion on Applied Physics （Structural Materials Science and Engineering）B (2.0credits) (応用物理学特別輪講

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Circle form	
Course Name	Applied Physics	
Starts 1	1 Autumn Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

In the lecture on structural Physics, 1. Recognizing the importance of studying the structure of materials, 2. Understanding traditional methods of structural analysis, 3. To deepen the understanding of practical methods of structural study methods such as X-ray diffraction method, 4. We study related books by participants for the purpose of learning recent experiment method or recent analysis method. Select books for each year. We will deepen discussion and understanding by solving exercises etc on our own.

●Prerequisite Subjects

Solid state physics, quantum mechanics, statistical mechanics etc.

●Course Topics

The purpose of the present course is to obtain the basic knowledge for studying the structural physics. In the classes, we will perform below,1. Reading the textbook and discussions. Students read and explain the contents of the textbook in turn, and perform the discussion after that. 2. Soving the questions relating to the textbook. Students are required to acquire the knowledge completely.In order to enhance the class effect, it is necessary to prepare in advance and review after the class.

●Textbook

TBD

●Additional Reading

Introduction to Solid State Physics by C. Kittel,Synchrotron Radiation Crystallography by P.Coppens, X-ray Diffraction by B.E. Warren,

●Grade Assessment

Evaluate the target achievement level by question-and-answer at the time of presentation. Pass score of 60 points or more with 100 full marks.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

d Discussion on Applied Physics （Magnetic Materials Engineering） A (2.0credits) (応用物理学特別輪講（磁性材

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

Correlated electrons in a solid produce various functional properties of materials. In this lecture, physical properties of correlated-electron materials are briefly reviewed to ground a fundamental basis of the knowledge on physics of correlated electrons and to acquire practical skills required for research and development of functional materials.

Outcomes
1. The ability to understand basis of band theory and to predict physical properties of a solid.
2. The ability to understand effects of electronic correlations on physical properties of a solid.
3. The ability to explain the physical properties, such as magnetic, electronic, and optical properties, of a solid.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids.

●Course Topics

1. Crystal Structure, 2. Wave Diffraction and the Reciprocal Lattice, 3. Crystal Binding and Elastic Constants, 4. Phonons, 5. Free Electron Fermi Gas, 6. Energy Bands, 7. Semiconductor Crystals, 8. Fermi Surfaces and Metals, 9. Superconductivity.

Students learn above topics in a colloquium form.

●Textbook

C. Kittel, Introduction to Solid State Physics, 8th Edition (Wiley).

●Additional Reading

N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Evaluated by solutions on whiteboard and reports.
Pass mark 60/100

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

d Discussion on Applied Physics （Magnetic Materials Engineering）B (2.0credits) (応用物理学特別輪講（磁性材

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

Correlated electrons in a solid produce various functional properties of materials. In this lecture, physical properties of correlated-electron materials are briefly reviewed to ground a fundamental basis of the knowledge on physics of correlated electrons and to acquire practical skills required for research and development of functional materials.

Outcomes
1. The ability to understand basis of band theory and to predict physical properties of a solid.
2. The ability to understand effects of electronic correlations on physical properties of a solid.
3. The ability to explain the physical properties, such as magnetic, electronic, and optical properties, of a solid.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Reading and Discussion on Applied Physics Magnetic Materials EngineeringA.

●Course Topics

1. Crystal Structure, 2. Wave Diffraction and the Reciprocal Lattice, 3. Crystal Binding and Elastic Constants, 4. Phonons, 5. Free Electron Fermi Gas, 6. Energy Bands, 7. Semiconductor Crystals, 8. Fermi Surfaces and Metals, 9. Superconductivity.

Students learn above topics in a colloquium form.

●Textbook

C. Kittel, Introduction to Solid State Physics, 8th Edition (Wiley).

●Additional Reading

N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Evaluated by solutions on whiteboard and reports.
Pass mark 60/100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Reading and Discussion on Applied Physics Magnetic Materials EngineeringA.

●Contacting Faculty

Questions are welcome within or after each lecture.

Discussion on Applied Physics (Computational Engineering Mathematics) A (2.0credits) (応用物理学特別輪講（計

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading some latest books related to computational science and engineering, especially numerical algorithms, students are encouraged to master how to advance his/her own research, as well as to learn recent developments in the field.

●Prerequisite Subjects

Numerical algorithms

●Course Topics

Topics are selected from the following important areas of computational science and engineering.: Numerical algorithms, Optimization, High-performance computing.Preparation for the next class, e.g., understanding technical terms, is required.

●Textbook

A text book is chosen at the beginning of the semester.

●Additional Reading

●Grade Assessment

Oral Examination

●Notes

●Contacting Faculty

At the end of the class

Discussion on Applied Physics (Computational Engineering Mathematics) B (2.0credits) (応用物理学特別輪講（計

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading some latest books related to computational science and engineering, especially numerical algorithms including some applications, students are encouraged to master how to advance his/her own research, as well as to learn recent developments in the field.

●Prerequisite Subjects

●Course Topics

Topics are selected from the following important areas of computational science and engineering.: Numerical algorithms, Optimization, High-performance computing.Preparation for the next class, e.g., understanding technical terms, is required.

●Textbook

A textbook is chosen at the beginning of the semester.

●Additional Reading

●Grade Assessment

Oral Examination

●Notes

●Contacting Faculty

At the end of the class

ussion on Applied Physics （Computational Condensed Matter Physics） A (2.0credits) (応用物理学特別輪講（

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

By reading the fundamental literature in biophysics, basic methods and ways of thinking for creative work in the graduate course are obtained through discussions.

●Prerequisite Subjects

●Course Topics

Selected papers or texts will be read and discussed during the seminar.

●Textbook

Books or papers will be assigned during the seminar.

●Additional Reading

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

●Contacting Faculty

At any time in the laboratory, including the time during the seminar.

ussion on Applied Physics （Computational Condensed Matter Physics） B (2.0credits) (応用物理学特別輪講（

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

By reading the advanced literature in biophysics, basic methods and ways of thinking for creative work in the graduate course are obtained through discussions.

●Prerequisite Subjects

●Course Topics

Selected papers or texts will be read and discussed during the seminar.

●Textbook

Books or papers will be assigned during the seminar.

●Additional Reading

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

●Contacting Faculty

At any time in the laboratory, including the time during the seminar.

ding and Discussion on Applied Physics （Crystal Physics） A (2.0credits) (応用物理学特別輪講（結晶物性工学

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Lectures on statistical physics of phase transitions and nonlinear and non-equilibrium phenomena, and the analyses of atomic and electronic structures of micro-clusters with electron microscopy, electron diffraction and electron-energy loss spectroscopy.

●Prerequisite Subjects

Crystal Physics,Material Physics

●Course Topics

1. Phase transitions and critical phenomena2. Phase transitions of crystals and liquid crystals3. Atomic structure of micro-clusters4. Electronic structure of micro-clusters

●Textbook

Principles of the Theory of Solids 2nd ed., J. M. Ziman, Cambridge University Press

●Additional Reading

Statistical Physics: Landau and LifshitzIntroduction to Solid State Physics, 8th ed., C. Kittel, WileySolid State Physics, Neil W. Ashcroft, N. David Cornell, Thomson Press (India) Ltd.

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted in the seminar

ding and Discussion on Applied Physics （Crystal Physics） B (2.0credits) (応用物理学特別輪講（結晶物性工学

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Lectures on statistical physics of phase transitions and nonlinear and non-equilibrium phenomena, and the analyses of atomic and electronic structures of micro-clusters with electron microscopy, electron diffraction and electron-energy loss spectroscopy.

●Prerequisite Subjects

Crystal Physics,Material Physics

●Course Topics

1. Phase transitions and critical phenomena2. Phase transitions of crystals and liquid crystals3. Atomic structure of micro-clusters4. Electronic structure of micro-clusters

●Textbook

Principles of the Theory of Solids 2nd ed., J. M. Ziman, Cambridge University Press

●Additional Reading

Statistical Physics: Landau and LifshitzIntroduction to Solid State Physics, 8th ed., C. Kittel, WileySolid State Physics, Neil W. Ashcroft, N. David Cornell, Thomson Press (India) Ltd.

●Grade Assessment

The score is graded by an achievement via oral examinations

●Notes

None

●Contacting Faculty

Questions are accepted during the seminar

and Discussion on Applied Physics （Nano-Structural Analysis）A (2.0credits) (応用物理学特別輪講（ナノ構造解

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

We will evaluate by interview during the lecture.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

and Discussion on Applied Physics （Nano-Structural Analysis）B (2.0credits) (応用物理学特別輪講（ナノ構造解

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Circle form		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface2. Topological superconductivity and topological quantum computation3. Electric field induced superconductivity and Josephson junctions4. Novel physics on Majorana quasiparticles and axion dark matters5. Surface physics of low-dimensional nanostructures on graphene and nanotube6. Structures and physical properties of nano-materialsPrepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

We will evaluate by interview during the lecture.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Seminar on Solid State Engineering 1A (2.0credits) (物性基礎工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study the physical phenomena in condensed matter physics from a microscopic point of view, students read suitable textbooks and papers and learn theoretical methods on electron properties of solids, magnetism, superconductivity and quantum phenomena in semiconductors and cold atoms.
Purposes:
1. Students are able to perform calculations on theoretical problems on quantum many body problems.
2. Students understand and can explain several phenomena of electron properties in solids and superconductivity and superfluidity.

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4

●Course Topics

Understand the background of research on superconductivity, cold atomic gases, topological materials, etc.

●Textbook

Reference books and articles based on your theme will be given as appropriate.

●Additional Reading

C. J. Pethick and H. Smith, “Bose–Einstein Condensation in Dilute Gases” (Cambridge University Press)
L. P. Pitaevskii and S. Stringari, “Bose-Einstein Condensation” (International Series of Monographs on Physics)

●Grade Assessment

Evaluate the achievement of the goals based on daily learning and research results, their discussions, oral presentations at seminars, and questions and answers.

●Notes

Basics of Quantum Mechanics and statistical physics

●Contacting Faculty

At each seminar.

Seminar on Solid State Engineering 1B (2.0credits) (物性基礎工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study the physical phenomena in condensed matter physics from a microscopic point of view, students read suitable textbooks and papers and learn theoretical methods on electron properties of solids, magnetism, superconductivity and quantum phenomena in semiconductors.
Purposes:
1. Students are able to perform calculations on theoretical problems on quantum many body problems.
2. Students understand and can explain several phenomena of electron properties in solids and superconductivity and superfluidity.

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4, Seminar on Solid State Engineering 1A

●Course Topics

Understand the background of research on superconductivity, cold atomic gases, topological materials, etc., and set unsolved problems to be addressed.

●Textbook

Reference books and articles based on your theme will be given as appropriate.

●Additional Reading

C. J. Pethick and H. Smith, “Bose–Einstein Condensation in Dilute Gases” (Cambridge University Press)
L. P. Pitaevskii and S. Stringari, “Bose-Einstein Condensation” (International Series of Monographs on Physics)

●Grade Assessment

Evaluate the achievement of the goals based on daily learning and research results, their discussions, oral presentations at seminars, and questions and answers.

●Notes

Basics of quantum mechanics and statistical physics

●Contacting Faculty

At each seminar.

Seminar on Solid State Engineering 1C (2.0credits) (物性基礎工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study the materials and physical phenomena from a microscopic point of view, students read suitable papers and learn theoretical methods on electron properties of solids, superconductivity/superfluidity, topological insulators and relevant topological quantum phenomena. Students are required to solve new problems in condensed matter physics, summarize the results, and give a presentation.
Purposes:
Students can solve new problems in one of the following systems:
1. Topological Superconductor, topological insulators, and related materials
2. Cold atoms
3. Monolayer materials
4. New frontiers of magnetism (Skyrmion)

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4, Read and Discussion on Applied Physics (Solid State Engineering) 1A & 1B

●Course Topics

Deal with unresolved issues regarding superconductivity, cold atomic gases, topological materials, etc., and obtain new knowledge.

●Textbook

Reference books and articles based on your theme will be given as appropriate.

●Additional Reading

L. P. Pitaevskii and S. Stringari, “Bose-Einstein Condensation” (International Series of Monographs on Physics)

●Grade Assessment

Evaluate the achievement of the goals based on daily learning and research results, their discussions, oral presentations at seminars, and questions and answers.

●Notes

Basics of quatum mechanics, statistical physics, superconductivity and superfluidity.

●Contacting Faculty

At each seminar and discussion time.

Seminar on Solid State Engineering 1D (2.0credits) (物性基礎工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study the materials and physical phenomena from a microscopic point of view, students read suitable papers and learn theoretical methods on electron properties of solids, superconductivity/superfluidity, topological insulators, and relevant topological quantum phenomena. Students are required to solve new problems in condensed matter physics, summarize the results, and give a presentation.
Purposes:
Students can solve new problems in the following systems:
1. Topological Superconductor, topological insulators, and related materials
2. Cold atoms
3. Monolayer materials
4. New frontiers of magnetism (Skyrmion)

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4, Read and Discussion on Applied Physics (Solid State Engineering) 1A-1C

●Course Topics

Deal with unresolved issues regarding superconductivity, cold atomic gases, topological materials, etc., and obtain new knowledge. Summarize the obtained result and make presentations at academic societies and workshops outside the university.

●Textbook

Not specified

●Additional Reading

None

●Grade Assessment

Evaluate the achievement of the goals based on daily learning and research results, their discussions, oral presentations at seminars, and questions and answers.

●Notes

Basics of quatum mechanics, statistical physics, superfluidity and many body physcis.

●Contacting Faculty

At each seminar and discussion time.

Seminar on Optical Science and Engineering 1A (2.0credits) (光物理工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Acquire the basic skills to understand the electronic and optical properties of condensed matter and nanoscience.
Acquire the skills to apply the latest researches and methods to the study.

Goal of study:
1. Understanding of electronic and optical properties of condensed matter and nanoscience.
2. Acquire the ability to make presentations and discussions based on the content of English papers.
3. Acquire the ability to make discussions about the experimental techniques and the latest research trends based on the textbook knowledge.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 1B (2.0credits) (光物理工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Acquire the basic skills to understand the electronic and optical properties of condensed matter and nanoscience.
Acquire the skills to apply the latest researches and methods to the study.

Goal of study:
1. Understanding of electronic and optical properties of condensed matter and nanoscience.
2. Acquire the ability to make presentations and discussions based on the content of English papers.
3. Acquire the ability to make discussions about the experimental techniques and the latest research trends based on the textbook knowledge.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 1C (2.0credits) (光物理工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose
Acquire the basic skills to understand the electronic and optical properties of condensed matter and nanoscience.
Acquire the skills to apply the latest researches and methods to the study.

Goal of study:
1. Understanding of electronic and optical properties of condensed matter and nanoscience.
2. Acquire the ability to make presentations and discussions based on the content of English papers.
3. Acquire the ability to make discussions about the experimental techniques and the latest research trends based on the textbook knowledge.

●Prerequisite Subjects
Quantum Mechanics, Optics, Solid State Physics

●Course Topics
1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook
We choose papers from international journals.

●Additional Reading
We will introduce appropriate references as needed.

●Grade Assessment
Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes
Not required.

●Contacting Faculty
You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 1D (2.0credits) (光物理工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose
Acquire the basic skills to understand the electronic and optical properties of condensed matter and nanoscience.
Acquire the skills to apply the latest researches and methods to the study.

Goal of study:
1. Understanding of electronic and optical properties of condensed matter and nanoscience.
2. Acquire the ability to make presentations and discussions based on the content of English papers.
3. Acquire the ability to make discussions about the experimental techniques and the latest research trends based on the textbook knowledge.

●Prerequisite Subjects
Quantum Mechanics, Optics, Solid State Physics

●Course Topics
1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook
We choose papers from international journals.

●Additional Reading
We will introduce appropriate references as needed.

●Grade Assessment
Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes
Not required.

●Contacting Faculty
You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Quantum Physics in Condensed Matter 1A (2.0credits) (量子物性工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 1B (2.0credits) (量子物性工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 1C (2.0credits) (量子物性工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 1D (2.0credits) (量子物性工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Structural Materials Science and Engineering 1A (2.0credits) (構造物性工学セミナー1A)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	1 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on microstructure engineering deals with structure of crystalline materials. It is composed of a series of 4 seminars, that is, seminar on structure engineering 1A to 1D. The aims of the 4 seminars are 1. to understand the importance

●Prerequisite Subjects

Solid state physics, Diffraction crystallography, Statistical mechanics, Quantum mechanics

●Course Topics

1.To understand the importance to know crystal structure. 2.What is the origin of particular physical properties? 3.To know the properties which are sensitive with structure changes. 4.To know the properties which are not very sensitive with structure charcters

In the class, we will distribute English monographs on structures, articles on English sentences, and original papers written in English. Read these carefully before class and try to increase educational effectiveness.

●Textbook

The text will be chosen from monographs, review articles or original papers.

●Additional Reading

Introduction to Solid State Physics by C. Kittel,Synchrotron Radiation Crystallography by P.Coppens, X-ray Diffraction by B.E. Warren,

●Grade Assessment

Oral Examination and reports

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 1B (2.0credits) (構造物性工学セミナー1B)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	1 Autumn Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on microstructure engineering deals with structure of crystalline materials. It is composed of a series of 4 seminars, that is, seminar on structure engineering 1A to 1D. The aims of the 4 seminars are 1. to understand the importance of structure engineering, 2. to understand conventional methods of crystal structure analyses, 3. to study practical aspects of experimental technique, and 4. to learn advanced experimental and analytical methods. In 1B, the emphasis is to learn diffraction physics.

●Prerequisite Subjects

Solid state physics, Diffraction crystallography, Statistical mechanics, Quantum mechanics

●Course Topics

1. Discovery of X-ray. 2. The establishment of X-ray diffraction. 3.The crystal structure analyses by single crystal specimens. 4. The crystal structure analyses by powder specimens. 5.The least squares analyses and Fourier method. 6.The advent of Synchrotron.

In the class, we will distribute English monographs on structures, articles on English sentences, and original papers written in English. Read these carefully before class and try to increase educational effectiveness.

●Textbook

The text will be chosen from monographs, review articles or original papers.

●Additional Reading

Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel, X-ray Diffraction by B.E. Warren, Solid State Physics by H. Ibach and H. Luth

●Grade Assessment

Oral Examination and reports

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 1C (2.0credits) (構造物性工学セミナー1C)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	2 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on microstructure engineering deals with microstructure of crystalline materials. It is composed of a series of 4 seminars, that is, seminar on microstructure engineering 1A to 1D. The aims of the 4 seminars are 1. to understand the importance of microstructure engineering, 2. to understand conventional methods of crystal structure analyses, 3. to study practical aspects of experimental technique, and 4. to learn advanced experimental and analytical methods. In 1C, the emphasis is to study practical aspects of experimental technique.

●Prerequisite Subjects

Solid state physics, Diffraction crystallography, Statistical mechanics, Quantum mechanics

●Course Topics

1. Bragg Equation and Laue function. 2. Eward Sphere and Resolution. 3. 4-circle diffractmater and single crystal diffraction. 4. CCD Detector. 5. Imaging Plate. 6.Difference map.

In the class, we will distribute English monographs on structures, articles on English sentences, and original papers written in English. Read these carefully before class and try to increase educational effectiveness.

●Textbook

The text will be chosen from monographs, review articles or original papers.

●Additional Reading

Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel, X-ray Diffraction by B.E. Warren,Solid State Physics by H. Ibach and H. Luth

●Grade Assessment

Oral Examination

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 1D (2.0credits) (構造物性工学セミナー1D)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	2 Autumn Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on structure engineering deals with structure of crystalline materials. It is composed of a series of 4 seminars, that is, seminar on structure engineering 1A to 1D. The aims of the 4 seminars are 1. to understand the importance

●Prerequisite Subjects

Solid state physics, Diffraction crystallography, Statistical mechanics, Quantum

●Course Topics

1. What is Synchrotron Radiation? 2. The principle of generation of Synchrotron Radiation. 3. Powder X-ray diffraction by Synchrotron Radiation. 4. Structure analyses by Rietveld refinements. 5. Charge densities by Maximum Entropy Method. 6. MEM/Rietveld analysis technique

In the class, we will distribute English monographs on structures, articles on English sentences, and original papers written in English. Read these carefully before class and try to increase educational effectiveness.

●Textbook

The text will be chosen from monographs, review articles or original papers.

●Additional Reading

Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel, X-ray Diffraction by B.E. Warren,

●Grade Assessment

Oral Examination and reports

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Magnetic Materials Engineering1A (2.0credits) (磁性材料工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.

Goals:

1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering1B (2.0credits) (磁性材料工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.
Goals:
1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminar on Magnetic Materials Engineering 1A

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminar on Magnetic Materials Engineering 1A.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering1C (2.0credits) (磁性材料工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.
Goals:
1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminars on Magnetic Materials Engineering 1A and 1B

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

the passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminars on Magnetic Materials Engineering 1A and 1B.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering1D (2.0credits) (磁性材料工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.Goals:1. Undersitanding the basic physics producing material functions.2. Analyzing characteristic properties from various aspects3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminars on Magnetic Materials Engineering 1A, 1B, and 1C

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State ChmesitryThe latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminars on Magnetic Materials Engineering 1A, 1B, and 1C.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Computational Engineering Mathematics 1A (2.0credits) (計算数理工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 1B (2.0credits) (計算数理工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 1C (2.0credits) (計算数理工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 1D (2.0credits) (計算数理工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Condensed Matter Physics 1A (2.0credits) (計算物性工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

Goals

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

To be designated.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Questions are encouraged within or after the seminar.

Seminar on Computational Condensed Matter Physics 1B (2.0credits) (計算物性工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

Goals
1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

To be designated.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Questions are welcome within or after the seminar.

Seminar on Computational Condensed Matter Physics 1C (2.0credits) (計算物性工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

Goals

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

To be designated.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Questions are welcome within or after the seminar.

Seminar on Computational Condensed Matter Physics 1D (2.0credits) (計算物性工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

Goals

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

To be designated.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Questions are welcome within or after the seminar.

Seminar on Crystal Physics 1A (2.0credits) (結晶物性工学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects

Advanced Lectures on Condensed Matter Physics I,II

●Course Topics

1. Electron optics, 2. Electron microscope, 3. Interaction between electrons and specimens, 4. Scattering by amorphous specimen and its phase contrast, 5. Electron diffraction, 6. Various modes of electron diffraction and applications, 7. Imaging of crystalline specimens and lattice defects, 8. Elemental analysis by EDX and EELS, 9. Radiation damages by fast electrons

●Textbook

Transmission Electron Microscopy, L. Reimer, Springer

●Additional Reading

Transmission Electron Microscopy I - IV, David. B. Williams and Barry C. Carter, Springer.

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted during the seminar.

Seminar on Crystal Physics 1B (2.0credits) (結晶物性工学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose
Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects
Advanced Lectures on Condensed Matter Physics I,II

●Course Topics
1. Electron optics, 2. Electron microscope, 3. Interaction between electrons and specimens, 4. Scattering by amorphous specimen and its phase contrast, 5. Electron diffraction, 6. Various modes of electron diffraction and applications, 7. Imaging of crystalline specimens and lattice defects, 8. Elemental analysis by EDX and EELS, 9. Radiation damages by fast electrons

●Textbook
Transmission Electron Microscopy, L. Reimer, Springer

●Additional Reading
Transmission Electron Microscopy I - IV, David. B. Williams and Barry C. Carter, Springer.

●Grade Assessment
Oral test

●Notes
None

●Contacting Faculty
Questions are accepted during the seminar.

Seminar on Crystal Physics 1C (2.0credits) (結晶物性工学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects

Crytal Physics,Material Physics

●Course Topics

1. Electron optics, 2. Electron microscope, 3. Interaction between electrons and specimens, 4. Scattering by amorphous specimen and its phase contrast, 5. Electron diffraction, 6. Various modes of electron diffraction and applications, 7. Imaging of crystalline specimens and lattice defects, 8. Elemental analysis by EDX and EELS, 9. Radiation damages by fast electrons

●Textbook

●Additional Reading

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted during the seminar.

Seminar on Crystal Physics 1D (2.0credits) (結晶物性工学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose
Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects
Advanced Lectures on Condensed Matter Physics I,II

●Course Topics
1. Phase transitions and critical phenomena
2. Phase transitions of crystals and liquid crystals
3. Atomic structure of micro-clusters
4. Electronic structure of micro-clusters

●Textbook
Transmission Electron Microscopy, L. Reimer, Springer

●Additional Reading
Transmission Electron Microscopy I - IV, David. B. Williams and Barry C. Carter, Springer.

●Grade Assessment
Oral test

●Notes
None

●Contacting Faculty
Questions are accepted during the seminar.

Seminar on Nano-Structural Analysis 1A (2.0credits) (ナノ構造解析学セミナー1A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Seminar on Nano-Structural Analysis 1B (2.0credits) (ナノ構造解析学セミナー1B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture

Seminar on Nano-Structural Analysis 1C (2.0credits) (ナノ構造解析学セミナー1C)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Instructors:

Seminar on Nano-Structural Analysis 1D (2.0credits) (ナノ構造解析学セミナー1D)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Instructors:

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

●Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant’s research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

●Textbook
Will be introduced at the host laboratory depending on the research subject

●Additional Reading
Will be introduced at the host laboratory if necessary

●Grade Assessment
Conducting research in an abroad laboratory for one semester and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

●Notes
Nothing particularly needed

●Contacting Faculty
Questions will be answered by the supervisors at the host laboratory during the course.

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

●Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant’s research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

●Textbook
Will be introduced at the host laboratory depending on the research subject

●Additional Reading
Will be introduced at the host laboratory if necessary

●Grade Assessment
Conducting research in an abroad laboratory for two semesters and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

●Notes
Nothing particularly needed

●Contacting Faculty
Questions will be answered by the supervisors at the host laboratory during the course.

Experimental Research and Exercises on Solid State Engineering A (2.0credits) (物性基礎工学特別実験・演習A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study physical phenomena in quantum physics and statistical physics from a microscopic point of view, students read related articles and give presentations about them, with collecting information needed to understand the articles by themselves. Students learn basic theoretical methods in quantum physics, statistical physics, and solid-state physics, and apply them for some basic models.
Purposes:
1. Students learn basic on quantum statistical physics.
2. Students are able to solve some models analytically or numerically.
3. Students can read and understand the foremost research papers.

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4

●Course Topics

Students read articles on recent topics of superconductivity, superfluidity and topological materials, and give an oral presentation about them. Students also write a report on presentations from other group members.

●Textbook

not specified.

●Additional Reading

"Bose-Einstein Condensation in Dilute Gases", C. J. Pethick and H. Smith, Cambridge University Press
"Bose-Einstein Condensation", L. P. Pitaevskii and S. Stringari, International Series of Monographs on Physics
"superconductivity", J. B. Ketterson and S. N, Song, Cambridge University Press

●Grade Assessment

Oral presentation, discussion at each seminar, and report

●Notes

Basic knowledge of Quantum physics, statistical physics, and solid-state physics are required.

●Contacting Faculty

At each seminar

Experimental Research and Exercises on Solid State Engineering B (2.0credits) (物性基礎工学特別実験・演習B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

In order to study physical phenomena in quantum physics and statistical physics from a microscopic point of view, students read a related textbook and give presentations about them, with collecting information needed to understand the articles by themselves. Students learn basic theoretical methods in quantum physics, statistical physics, and solid-state physics, and apply them for some basic models.
Purposes:
1. Students learn basic on quantum statistical physics.
2. Students are able to solve some models analytically or numerically.
3. Students can read and understand foremost research papers.

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4, Experimental Research and Exercises on Solid State Engineering A

●Course Topics

Students read articles on recent topics of superconductivity, superfluidity and topological materials, and give an oral presentation about them. Students also write a report on presentations from other group members.

●Textbook

not specified.

●Additional Reading

"Bose-Einstein Condensation in Dilute Gases", C. J. Pethick and H. Smith, Cambridge University Press
"Bose-Einstein Condensation", L. P. Pitaevskii and S. Stringari, International Series of Monographs on Physics
"superconductivity", J. B. Ketterson and S. N, Song, Cambridge University Press

●Grade Assessment

Oral presentation, discussion at each seminar, and report

●Notes

Basic knowledge of Quantum physics, statistical physics, and solid-state physics are required.

●Contacting Faculty

At each seminar

Experimental Research and Exercises on Optical Science and Engineering A (2.0credits) (光物理工学特別実験・演習

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

To study the optical physics. The optical experiment is a powerful tool to study the electronic properties. We can find novel phenomena even on the known materials by adopting a new experimental method. Moreover, we can expect novel optical phenomena on new materials. Through the above experiments, we search for new optical phenomena. Through a series of research activity, students solidify the basic skills in the field of engineering and obtain the applied skills to conduct researches.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetics, Optics.

●Course Topics

Students perform experimental study on various electronic properties concentrating on optical properties.

●Textbook

Not designated.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Progress of the research, presentations in meeting, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

As needed.

Experimental Research and Exercises on Optical Science and Engineering B (2.0credits) (光物理工学特別実験・演習

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

To study the optical physics. The optical experiment is a powerful tool to study the electronic properties. We can find novel phenomena even on the known materials by adopting a new experimental method. Moreover, we can expect novel optical phenomena on new materials. Through the above experiments, we search for new optical phenomena. Through a series of research activity, students solidify the basic skills in the field of engineering and obtain the applied skills to conduct researches.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetics, Optics.

●Course Topics

Students perform experimental study on various electronic properties concentrating on optical properties.

●Textbook

Not designated.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Progress of the research, presentations in meeting, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

As needed.

ental Research and Exercises on Quantum Physics in Condensed Matter A (2.0credits) (量子物性工学特別実験

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Students make experimental researches on the organic molecules, nano-carbon materials, atomically thin materials, and their functional devices, along one's own subjects. Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices2. Ion-driven novel functional devices3. Valleytronics based on atomically thin materials4. Electron spin resonance study of structure and property of organic solids 5. Electrical conduction and superconductivity of organic solids.Preparation for each subject should be made beforehand.

●Textbook

To be designated

●Additional Reading

To be designated

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are always acceptable

ental Research and Exercises on Quantum Physics in Condensed Matter B (2.0credits) (量子物性工学特別実験

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Students make experimental researches on the organic molecules, nano-carbon materials, atomically thin materials, and their functional devices, along one's own subjects. Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices2. Ion-driven novel functional devices3. Valleytronics based on atomically thin materials4. Electron spin resonance study of structure and property of organic solids 5. Electrical conduction and superconductivity of organic solids.Preparation for each subject should be made beforehand.

●Textbook

To be designated

●Additional Reading

To be designated

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are always acceptable

cal Research and Exercises on Structural Materials Science and Engineering A (2.0credits) (構造物性工学特別実

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Experiment and Exercise	
Course Name	Applied Physics	
Starts 1	1 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

We will acquire precise measurements and analysis methods from structural identification to electronic states of functional substances, which are usually difficult to analyze, mainly through experiments of state-of-the-art research using synchrotron radiation X-ray.

●Prerequisite Subjects

Solid state physics, quantum mechanics, statistical mechanics etc.

●Course Topics

In special experiments, we will understand through experiments the principles and practicalities of experimental methods and analysis of cutting edge research mainly using synchrotron radiation.

●Textbook

●Additional Reading

●Grade Assessment

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

cal Research and Exercises on Structural Materials Science and Engineering B (2.0credits) (構造物性工学特別実

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Experiment and Exercise	
Course Name	Applied Physics	
Starts 1	1 Autumn Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

We will acquire precise measurements and analysis methods from structural identification to electronic states of functional substances, which are usually difficult to analyze, mainly through experiments of state-of-the-art research using synchrotron radiation X-ray.

●Prerequisite Subjects

Solid state physics, quantum mechanics, statistical mechanics etc.

●Course Topics

In special experiments, we will understand through experiments the principles and practicalities of experimental methods and analysis of cutting edge research mainly using synchrotron radiation.

●Textbook

●Additional Reading

●Grade Assessment

●Notes

No course requirements

●Contacting Faculty

erimental Research and Exercises on Magnetic Materials Engineering A (2.0credits) (磁性材料工学特別実験・演

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

To acquire the applied skills for creation and integration through the study for master’s thesis

Outcomes
1. The ability to analyze the previous studies on functional materials and to find a new problem.
2. The ability to find the solution for the research theme.
3. The ability to explain the research results by an oral presentation and an article.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics.

●Course Topics

Students study new scientific problems through experiments, analyses, and discussion on the following topics.

1. Magnetism of Transitional-Metal-Based Alloys and Compounds and Their Applications.
2. Electronic Functionalities of Frustrated Systems.
3. Novel Actuating Materials.
4. Thermal Expansion Control by Negative Thermal Expansion Materials.
5. Novel Functionalities of Bio- and Soft-Materials.

●Textbook

Materials will be distributed each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Evaluated by research activity in the laboratory. The criteria for passing is to achieve the research project on electronic phase control for development of novel functional materials. Passing grade: 60 points out of 100.

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

Experimental Research and Exercises on Magnetic Materials Engineering B (2.0credits) (磁性材料工学特別実験・演

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

To acquire the applied skills for creation and integration through the study for master's thesis

Outcomes
1. The ability to analyze the previous studies on functional materials and to find a new problem.
2. The ability to find the solution for the research theme.
3. The ability to explain the research results by an oral presentation and an article.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Experimental Research and Exercises on Magnetic Materials Engineering A.

●Course Topics

Students study new scientific problems through experiments, analyses, and discussion on the following topics.

1. Magnetism of Transitional-Metal-Based Alloys and Compounds and Their Applications.
2. Electronic Functionalities of Frustrated Systems.
3. Novel Actuating Materials.
4. Thermal Expansion Control by Negative Thermal Expansion Materials.
5. Novel Functionalities of Bio- and Soft-Materials.

●Textbook

Materials will be distributed each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Evaluated by research activity in the laboratory. The criteria for passing is to achieve the research project on electronic phase control for development of novel functional materials. Passing grade: 60 points out of 100.

●Notes

There is no requirement for taking this class, but it is desired to have already finished Experimental Research and Exercises on Magnetic Materials Engineering A.

●Contacting Faculty

Questions are welcome within or after each lecture.

ental Research and Exercises on Computational Engineering Mathematics A (2.0credits) (計算数理工学特別実験

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading original papers related to computational science and engineering, especially numerical algorithms, students are encouraged to master how to advance his/her own research, as well as to learn recent developments in the field.

●Prerequisite Subjects

Numerical algorithms

●Course Topics

Topics are selected from the following important areas of computational science and engineering.: Numerical algorithms.

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination

●Notes

●Contacting Faculty

ental Research and Exercises on Computational Engineering Mathematics B (2.0credits) (計算数理工学特別実験

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading original papers related to computational science and engineering, especially numerical algorithms with applications, students are encouraged to master how to advance his/her own research, as well as to learn recent developments in the field.

●Prerequisite Subjects

Numerical algorithms

●Course Topics

Topics are selected from the following important areas of computational science and engineering.: Numerical algorithms.

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination

●Notes

●Contacting Faculty

ntal Research and Exercises on Computational Condensed Matter Physics A (2.0credits) (計算物性工学特別実験

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

To acquire the applied skills for creation and integration through the study for master's thesis.

●Prerequisite Subjects

●Course Topics

Each student must perform theoretical and computational research in the laboratory.

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

ntal Research and Exercises on Computational Condensed Matter Physics B (2.0credits) (計算物性工学特別実験

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

To acquire the applied skills for creation and integration through the study for master's thesis.

●Prerequisite Subjects

●Course Topics

Each student must perform theoretical and computational research in the laboratory.

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Experimental Research and Exercises on Crystal Physics A (2.0credits) (結晶物性工学特別実験・演習A)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose
Guidance to graduate works on nano-structured materials.

●Prerequisite Subjects
Seminar on Crystal Physics 1, Crytal Physics, Material Physics

●Course Topics
1. Phase transitions and critical phenomena2. Phase transitions of crystals and liquid crystals3. Atomic structure of micro-clusters4. Electronic structure of micro-clusters

●Textbook
None

●Additional Reading
None

●Grade Assessment
Paper review and oral examination

●Notes
None

●Contacting Faculty
Questions are accepted during the experiment.

Experimental Research and Exercises on Crystal Physics B (2.0credits) (結晶物性工学特別実験・演習B)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose
Guidance to graduation works on structure analysis by using electron beams

●Prerequisite Subjects
Seminar on Crystal Physics 1, Crytal Physics, Material Physics

●Course Topics
1. Phase transitions and critical phenomena2. Phase transitions of crystals and liquid crystals3. Atomic structure of micro-clusters4. Electronic structure of micro-clusters

●Textbook
None

●Additional Reading
None

●Grade Assessment
Paper review, oral examination

●Notes
None

●Contacting Faculty
Questions are accepted during the experiments.

Experimental Research and Exercises on Nano-Structural Analysis A (2.0credits) (ナノ構造解析学特別実験・演習A

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

We will evaluate by interview during the lecture.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Experimental Research and Exercises on Nano-Structural Analysis B (2.0credits) (ナノ構造解析学特別実験・演習

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

We will evaluate by interview during the lecture.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Advanced Lectures on Solid State Engineering (2.0credits) (物性基礎工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Spring Semester ,every other year	
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor

●Course Purpose

Lectures on the phenomena of superfluidity and superconductivity, which is one of the major topics in quantum many-body systems, will be given. Mathematical concept of topology and its application in physics is also discussed.

Purpose:
1. Second quantization
2. What is superfluidity/superconductivity
3. Quantum phenomena in superfluidity/supercondutivity
4. Topological quantum phenomena

●Prerequisite Subjects

Quantum physics A & B, Statistical physics A & B, Solid state physics 1-4

●Course Topics

Fermi and Bose statistics
Basics of Bloch’s theorem
Second quantization
Basics of Superconductivity
BCS theory
Unconventional superconductorsinglet /triplet
BdG equation and Andreev reflection
Tunneling and Josephson effect
Tunneling and Josephson effect in unconventional superconductors
Topological superconductivity and surface Andreev bound state
Majorana fermion
Bose-Einstein condensation
Mean-field description of superfluidity
Bogoliubof theory for bosonic systems
Spin algebra
Spinor Bose-Einstein condensates
Topology in condensed-matter physics
Introduction to topological insulators

●Textbook

Not specified.

●Additional Reading

Bose-Einstein Condensation (International Series of Monographs on Physics) (Clarendon Pr., 2003) L. P. Pitaevskii & S. Stringari
Physics Reports, Vol. 520, 253 (2012), Y. Kawaguchi and M. Ueda
Introduction to Superconductivity (McGraw-Hill, 1996), Tinkham
Reports on Progress in Physics Vol. 63, 1641 (2000), S. Kashiwaya and Y. Tanaka
Journal of the Physical Socuety of Japan 81, 011013 (2012), Y. Tanaka, M. Sato and N. Ngaosa

●Grade Assessment

report(100%)

●Notes

Basics of quantum mechanics, statistical physics and solid state physics.

●Contacting Faculty

After each lecture.

Advanced Lectures on Optical Science and Engineering (2.0credits) (光物理工学特論)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	Spring Semester ,every other year
Lecturer	Hideo KISHIDA Professor Takeshi KOYAMA Associate Professor

●Course Purpose

Light is a good probe to study physical properties of materials, and research on optical properties of condensed matter, i.e., interactions between light and matter, is involved in an interdisciplinary field of science today. The aim of this class is to understand the optical properties of matter based on quantum mechanics.

Outcomes
1. The ability to explain the optical processes quantum mechanically.
2. The ability to explain the relationship between the dielectric constants and electronic states in matter.
3. The ability to explain optical properties of various materials in terms of quantum mechanics.

Students acquire the basic skills to understand the optical properties of matter based on quantum mechanics and the applied skills to consider the electronic properties of novel materials.

●Prerequisite Subjects

1. Solid State Physics
2. Electromagnetics
3. Quantum Mechanics

●Course Topics

1. Semiclassical treatment of light-atom/light-molecule interactions
2. Quantization of electromagnetic field
3. Interaction of quantized field with atoms/molecules
4. Dielectric constants and optical spectra
5. Optical processes in condensed matter

●Textbook

Not designated.

●Additional Reading

In the lecture, we will introduce references in which the helpful explanation and figures are written as needed.

●Grade Assessment

Presentation/report.
The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

Students can ask questions after the class.
Contact addresses:
Koyama: koyama@nuap.nagoya-u.ac.jp
Kishida: kishida@nagoya-u.jp

Advanced Lectures on Quantum Physics in Condensed Matter (2.0credits) (量子物性工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Autumn Semester ,every other year	
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor

●Course Purpose

Lectures are given on the novel electronics using pi-electron materials.
Fundamentals of solid-state physics and semiconductor physics and
characteristics of organic materials, nano-carbon materials, and
atomic layer materials are reviewed. Recent applications for wearable devices
are also reviewed. Through these lectures, students learn basis for electronic properties of pi-electrons in solids and application toward electronics.

●Prerequisite Subjects

Quantum mechanics, Thermal and statistical physics, Electromagnetism, Solid state physics, Chemical physics

●Course Topics

1.Fundamentals of semiconductor physics, 2.Fundamentals of organic materials, 3.Fundamentals of nano-carbon materials, 4.Fundamentals of atomic layer materials, 5.Solid state physics on pi-electron materials, 6. Novel electronics using pi-electron materials
Preparation for each subject should be made beforehand.

●Textbook

To be designated

●Additional Reading

To be designated.

●Grade Assessment

Report

●Notes

No requirement

●Contacting Faculty

Taishi Takenobuphone:5173 e-mail:takenobunagoya-u.ac.jp
Hiroshi Itophone:5164 e-mail:itonuap.nagoya-u.ac.jp
Quentions are acceptable after lecture.

Advanced Lectures on Structural Materials Science and Engineering (2.0credits) (構造物性工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Autumn Semester ,every other year	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

In this lecture, the aim is to acquire the applied power of structural property research using quantum beams as advanced probes. In order to understand physical properties, it is necessary to examine various external field responses, and recent experimental research aims to pioneer new physical physics using state-of-the-art probes that have improved their performance to the utmost. In order to understand this unique and extremely interesting physical property, it is necessary to learn the basic principles of the data analysis method and to clarify the electronic state by determining the electron density. Learn the basic knowledge for developing unknown materials together with the group theory and crystal chemistry necessary for this.

●Prerequisite Subjects

solid state physics, condensed matter physics, diffraction physics theory

●Course Topics

1. diffraction principle; 2. Group theory in crystal structure; 3. crystal structure and periodic physics; 4. Electronic state and lattice dynamics; Phase stability and structural phase transition

●Textbook

●Additional Reading

●Grade Assessment

The evaluation for the achievement target is 40% for questions and answers during the lecture and 60% for report evaluation. A score of at least 60 out of 100 is acceptable.

●Notes

There are no course requirements, but students need basic understanding of quantum mechanics, statistical mechanics, Fourier analysis, etc.

●Contacting Faculty

Accept at any time

Advanced Lectures on Magnetic Materials Engineering (2.0credits) (磁性材料工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Spring Semester ,every other year	
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor

●Course Purpose

Correlated electrons in transition metals and their compounds produce various functional properties of materials. In this lecture, physical properties of correlated-electron materials, such as magnetic, optical and transport properties, are briefly reviewed to ground a fundamental basis of the knowledge on physics of correlated electrons.

Goals:

1. Understanding and explaining the physical background of the properties and functions of solid materials generated by correlated electrons.
2. Applying the above knowledges to the development of new functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Electron Theory of Metals, Solid State Physics

●Course Topics

1. Electronic Correlations and Mott Insulator, 2. Optical Properties, 3. Transport Properties, 4. Dielectric Properties, 5. Magnetic Properties of Atoms, 6. Various Magnetic Properties

●Textbook

P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxfird University Press)
Additoinal documents are distributed.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

(Evaluation method) In addition to the mid-term exam and the final exam, the evaluation will be based on several reports that are imposed during class. 80% exams, 20% reports.

(Evaluation criteria) Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

Advanced Lectures on Computational Engineering Mathematics (2.0credits) (計算数理工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Spring Semester ,every other year	
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor

●Course Purpose

Numerical algorithms for scientific computing are theoretically explained. The goal is to understand the principles of numerical algorithms and to correctly use the algorithms.

●Prerequisite Subjects

numerical analysis

●Course Topics

1. Algorithms for linear systems, 2 Algorithms for nonlinear equations, 3. Algorithms for eigenvalue problems, 4: Function approximation, 5: numerical integration, 6: Algorithms for differential equations

●Textbook

Not specified

●Additional Reading

Mori,ISBN:978-4-320-01701-6
Sugihara & Murota, ISBN:978-4-000-05518-5
Zhang (ed.), Sogabe & Yamamoto, ISBN:978-4-320-12266-6

●Grade Assessment

Reports and oral examination. Record more than 60/100 is qualified.

●Notes

Not specified

●Contacting Faculty

At the end of the class

Advanced Lectures on Computational Physics (2.0credits) (計算物性工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Spring Semester ,every other year	
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor

●Course Purpose

Theories and computational methods for studying meso-scopic systems such as nano-materials, biomolecules, and living cells are explained. The goal is

1. Understanding the concepts of coarse-graining and applying them to nano- and bio-systems.
2. Understanding basic simulation methods for coarse-grained simulation and stochastic simulation.
3. Understanding how computer simulation is used in protein science

●Prerequisite Subjects

Statistical Mechanics and Thermodynamics

●Course Topics

1. Brownian motion and Langevin equation
2. Diffusion equation and Fokker-Planck equation
3. Numerical integration of Langevin equations
4. Basics of protein science
5. Molecular dynamics simulations in protein science
6. Application of coarse-grained models to protein science

●Textbook

not specified

●Additional Reading

Stochastic Energetics (Lecture Notes in Physics, Springer) Ken Sekimoto
Molecular Modelling, Principles and Applications, Second Edition (Pearson Prentice Hall) Andrew R. Leach

●Grade Assessment

Reports. Record more than 60/100 is qualified.

●Notes

Basic knowledge of analytical calculation is required.

●Contacting Faculty

In the class or at the laboratory office

Advanced Lectures on Crystal Physics (2.0credits) (結晶物性工学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Spring Semester ,every other year	
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor

●Course Purpose

Nanoscience and nanotechnology is one of the important research fields of science and technology in 21 century. This lecture gives a general view of nanoscience and nanotechnology through various topics such as history of nanoscience and nanotechnology, specimen fabrication, structure characterization, unique properties and applications, on the basis of the knowledges of the undergraduate course.

●Prerequisite Subjects

ElectromagneticsQuantum Mechanics

●Course Topics

(1)What is nano technology?(2)Atomic structures of nano materials(3)Electronic structures of nano materials(4)Characteristic properties of nano materials(5)Application of nano materials

●Textbook

None

●Additional Reading

"Introduction to nanotechnology", Kyouritsu shuppan, 2006. "Illustrative knowledge of nanotechnology", Kogyochosa-kai, 2001.

●Grade Assessment

oral examination, exercises

●Notes

None

●Contacting Faculty

ext: 3597e-mail: kuwahara@imass.nagoya-u.ac.jp

Advanced Lectures on Nano-structural Analysis (2.0credits) (ナノ構造解析学特論)

Course Type	Specialized Courses	
Division at course	Master's Course	
Class Format	Lecture	
Course Name	Applied Physics	
Starts 1	Spring Semester ,every other year	
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer

●Course Purpose
Lectures on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects
Electromagnetism, Physical Properties of Crystalline Materials, Solid State Physics, Diffraction Crystallography

●Course Topics
1Introduction to superconductivity
2Principle and application of superconductors
3Electronic states of superconductors
4Topological quantum phenomena
5. Atomic structures of solid state materials
6. Diffraction by crystals
7. Structure analysis and Physical characterization by electron microscopy
8. Structures and physical properties of nanometer-sized materials

●Textbook
Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading
We will introduce references on demand.

●Grade Assessment
We will evaluate by examination and reports.

●Notes
Nothing special.

●Contacting Faculty
Answer during the lecture.

Large-scale Parallel Computing (2.0credits) (大規模並列数値計算特論)

Course Type	Specialized Courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Takahiro KATAGIRI Professor	Takashi UNEYAMA Associate Professor	Noriyuki YOSHII Designated Associate Professor

●Course Purpose

Learning how to use a high speed parallel computer. You will have programming practices using supercomputer at Nagoya university. The programming \ languages are Fortran and C. \ Target: \ 1. Understanding the state of the art of high speed parallel computer \ and parallel programming. \ 2. Acquiring fundamental skills of parallel programming.

●Prerequisite Subjects

Not specified, but taking some courses for programming is recommended.

●Course Topics

[1] High performance computing and its history
[2] Classification of concepts of high speed parallel computers and their state of the art
[3] Usage of high speed parallel computers
[4] Vector operations, multithreading and parallel processing
[5] Fundamentals of OpenMP
[6] Parallelization of Matrix-Vector Producs.
[7] Parallelization of Power iteration
[8] Parallelization of Matrix-Matrix Products (1)
[9] Parallelization of Matrix-Matrix Products (2)
[10] Use of Numerical Libraries.
[11] Application in Molecular dynamics simulations (1)
[12] Application in Molecular dynamics simulations (2)
[13] GPU Programming (1)
[14] GPU Programming (2)
Students are required to submit reports for several topics. Reports should be submitted before deadlines for each topics. Students should prepare for the calss beforehand.

●Textbook

Documents for lectures will be provided.

●Additional Reading

"Supakon wo shiru: Sono kiso kara saishin no doukou made", T. Iwashita, T. Katagiri, and D. Takahashi (in Japanese).
"Supakon purogramming nyuumon -heiretsu shori to MPI no gakusyuu-", T. Katagiri (in Japanese).
"Heiretsu programming nyuumon: Sample program de manabu OpenMP to OpenACC", T. Katagiri (in Japanese).
"Keisan kagaku no tame no heiretsu keisan -daikibo keisan heno daiippo-", Y. Kaneda, A. Sasai, K. Ishii (in Japanese).

●Grade Assessment

Evaluated by scores of reports. The weights for each targets of this course are the same.
The skills to explain the state of the art of high speed parallel computer and parallel programming, and to implement parallel programs, are evaluated by reports.

●Notes

Nothing is required.

●Contacting Faculty

Question time: after each lecture

General questions:
Center for computational Science, Graduate School of Engineering
http://ccs.engg.nagoya-u.ac.jp/
052-788-6215

Computational Science Lecture - Topics in Frontiers of Computational Science (2.0credits) (計算科学フロンティ

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	1 Autumn Semester
Lecturer	Takashi UNEYAMA Associate Professor

●Course Purpose

This is an omnibus lecture. The lectures are those who are doing the most advanced researches on the frontiers of computational science. You will know the recent advances, and understand fundamentals related to these fields.

1. To explain recent trends in several different areas of computational science.
2. To explain several research methods utilized in computational science.

●Prerequisite Subjects

Not specified, because the targets of this lecture are rather wide-spread.

●Course Topics

1. Frontiers in Solid State Physics
2. Frontiers in Solid Mechanics
3. Frontiers in Biological Science
4. Frontiers in Algorithm
5. Frontiers in Computational Chemistry

Students will be required to submit reports.

●Textbook

Documents will be provided at the lecture.

●Additional Reading

Some documents will be introduced at the lecture.

●Grade Assessment

Evaluation is based on reports on the problems given by every lecturer.
Skills to explain recent trends in several different areas of computational science, and to explain several research methods utilized in computational science are evaluated by reports.

●Notes

There is no requirement.

●Contacting Faculty

Question time: after each lecture

General questions:
Center for computational Science, Graduate School of Engineering
http://ccs.engg.nagoya-u.ac.jp/
052-788-6215

Advanced Lectures on Applied Physics I (1.0credits) (応用物理学特論　I)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Part-time Faculty

●Course Purpose
The aim of the lecture is to learn a recent topics in applied physics.

●Prerequisite Subjects
Subjects related to the Department of Applied Physics

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of applied physics.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Advanced Lectures on Applied Physics II (1.0credits) (応用物理学特論 II)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Part-time Faculty

●Course Purpose
The aim of the lecture is to learn a recent topics in applied physics.

●Prerequisite Subjects
Subjects related to the Department of Applied Physics

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of applied physics.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Advanced Lectures on Applied Physics III (1.0credits) (応用物理学特論 III)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Part-time Faculty

●Course Purpose
The aim of the lecture is to learn a recent topics in applied physics.

●Prerequisite Subjects
Subjects related to the Department of Applied Physics

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of applied physics.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Advanced Lectures on Applied Physics IV (1.0credits) (応用物理学特論 IV)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Part-time Faculty

●Course Purpose
The aim of the lecture is to learn a recent topics in applied physics.

●Prerequisite Subjects
Subjects related to the Department of Applied Physics

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of applied physics.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Advanced Lectures on Applied Physics V (1.0credits) (応用物理学特論 V)

Course Type	Specialized Courses
Division at course	Master's Course
Class Format	Lecture
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Part-time Faculty

●Course Purpose
The aim of the lecture is to learn a recent topics in applied physics.

●Prerequisite Subjects
Subjects related to the Department of Applied Physics

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of applied physics.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Innovation Practice Course (4.0credits) (イノベーション体験プロジェクト)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Experiment and Exercise		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Under the instruction of the company engineer (DP, Directing Professor), I carry out the project for the problem solution by the team of several people consisting of different specialisms. In this way, it is intended to let you sense ability for problem discovery, the importance of the general intellectual power of compound eyes on the basis of real world bodily.
I know a point of view, the plan as the company and perform a discussion, exchange of opinions between the different specialty and aim for the breeding of the viewpoint general, to see engineering by examining it as the problem solution person concerned from different angles.

●Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

●Course Topics

I organize different specialty, the team (several/team) consisting of the students of the department several sets, and DP is the instruction in each each team. Based on the project theme that DP determined, I set the problem that a student carries out concretely. For 75 hours (principle one day a week), I accomplish the project for the problem solution.
Prior lecture to affect a project theme by the DP
Setting (opinion, information exchange, allied investigation, examination, discussion) of the concrete problem by the student
Enforcement of the problem solution project
Summary, report of the result

I assume this a main component.
In addition, I may be given an investigation and the consideration in conjunction with the theme as a problem from DP. Report it in a date (the next time lectures) when it was appointed, and announce it; and a thing corresponding to the exchange of opinions in the team.

●Textbook

documents that a lecturer (DP) introduces it and shows.

●Additional Reading

documents that a lecturer (DP) introduces it and shows.

●Grade Assessment

I evaluate it through accomplishment, the discussion of the project, result announcement. If a consideration power, the adjustability for the problem solution, the expansion of the field of vision are accepted, it is said that I pass.

●Notes

There are no prerequisites

●Contacting Faculty

A lecturer (DP) and this project staff of the university accept questions at any time.

Research Internship１ U2 (2.0credits) (研究インターンシップ１ U2)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.
It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

●Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

●Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.
Orientation to affect the overall company concerned and the training medium
Enforcement (including cooperation, the adjustment with the company staff) of the training theme
Summary, report of the training result
I assume a report (presentation) of the training result to the university a main component.
As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

●Textbook
documents that the staff instructing the training in the company introduces it and shows

●Additional Reading
documents that the staff instructing the training in the company introduces it and shows

●Grade Assessment
I am given in the following on 20th in the total days that engaged in the training in the company.
I do that I announce the result to the university in a result briefing session to perform after the training if essential.
I evaluate it based on result announcement contents and an evaluation book of the training staff making. I recognize an experience-based effect in the training by oneself, and will to plan reflection to a study, the study at the university does it with a pass if admitted.

●Notes
The studnt that I subscribed for the training theme of the company, and acceptance was accepted.

●Contacting Faculty
The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship１ U3 (3.0credits) (研究インターンシップ１ U3)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.
It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

●Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

●Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.
Orientation to affect the overall company concerned and the training medium
Enforcement (including cooperation, the adjustment with the company staff) of the training theme
Summary, report of the training result
I assume a report (presentation) of the training result to the university a main component.
As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

●Textbook

documents that the staff instructing the training in the company introduces it and shows

●Additional Reading

documents that the staff instructing the training in the company introduces it and shows

●Grade Assessment

The credits will be given to the students who have had the working days between 21 and 40 days in the internship company.

●Notes

The studnt that I subscribed for the training theme of the company, and acceptance was accepted.

●Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship１ U4 (4.0credits) (研究インターンシップ１ U4)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.
It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

●Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

●Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.
Orientation to affect the overall company concerned and the training medium
Enforcement (including cooperation, the adjustment with the company staff) of the training theme
Summary, report of the training result
I assume a report (presentation) of the training result to the university a main component.
As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

●Textbook
documents that the staff instructing the training in the company introduces it and shows

●Additional Reading
documents that the staff instructing the training in the company introduces it and shows

●Grade Assessment
The credits will be given to the students who have had the working days between 41 and 60 days in the internship company.

●Notes
The studnt that I subscribed for the training theme of the company, and acceptance was accepted.

●Contacting Faculty
The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship１ U6 (6.0credits) (研究インターンシップ１ U6)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.
It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

●Prerequisite Subjects

It is strongly recommended to take the industry-university joint educational courses such as Focus on Venture Business and ,etc.

●Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.
Orientation to affect the overall company concerned and the training medium
Enforcement (including cooperation, the adjustment with the company staff) of the training theme
Summary, report of the training result
I assume a report (presentation) of the training result to the university a main component.
As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

●Textbook

documents that the staff instructing the training in the company introduces it and shows

●Additional Reading

documents that the staff instructing the training in the company introduces it and shows

●Grade Assessment

The credits will be given to the students who have had the working days between 61 and 80 days in the internship company.

●Notes

The studnt that I subscribed for the training theme of the company, and acceptance was accepted.

●Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

Research Internship１ U8 (8.0credits) (研究インターンシップ１ U8)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Through the training to affect technology development, the study of the company in the company is advanced, and experience the challenge to a practical problem. In this way, it is aimed for upbringing of human resources tying engineering to creation of the social value.
It is wider in a technique and a study, and a consciousness, ability to catch in a general viewpoint (utility, economy) and communication power is bred and aims for what is reflected by a study, the study at the university.

●Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

●Course Topics

In the company accepting an intern, I make the training (study) about the study theme that a company shows.
Orientation to affect the overall company concerned and the training medium
Enforcement (including cooperation, the adjustment with the company staff) of the training theme
Summary, report of the training result
I assume a report (presentation) of the training result to the university a main component.
As the associated document, documents investigation may not support during the working hours that a company sets, I do the attendance of the lecture about "the handling, a point to keep in mind by basic knowledge and the study internship of intellectual property rights" to need what I study in the training overtime by oneself, and to perform on the university side prior to the company training again with

requisiteness.

●Textbook

documents that the staff instructing the training in the company introduces it and shows

●Additional Reading

documents that the staff instructing the training in the company introduces it and shows

●Grade Assessment

The credits will be given to the students who have had the working days more than or equal to 81 daysin the internship company.

●Notes

The studnt that I subscribed for the training theme of the company, and acceptance was accepted.

●Contacting Faculty

The training staff of the company and the study internship staff of the university accept questions at any time.

Advanced Lectures on Frontier Technologies and Sciences (1.0credits) (最先端理工学特論)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Syusaku NAGANO Associate Professor		

●Course Purpose

To research in advanced engineering, it is necessary to learn the latest research trends through practice. Through symposium-style academic discussions, students will be able to study cutting-edge science and engineering research and discuss the latest trends in the subject areas.

●Prerequisite Subjects

Knowledge of the subject areas.

●Course Topics

Participated in special lectures set every year from the fields of biochemistry, analysis, semiconductors, polymers, and startups related to cutting-edge science and engineering, and participated in a symposium where research presentations on cutting-edge engineering were presented. By participating, students will study cutting-edge science and engineering research and discuss the latest trends in the subject areas. After taking the course, study and study the relevant field in detail.

●Textbook

Distribute as appropriate.

●Additional Reading

Distribute as appropriate.

●Grade Assessment

Report. A score of 60 or more out of 100 will be passed. Pass if you have a broad understanding of the subject area. Highly appreciate the point of contact with your own research, new business and research

proposals.

●Notes

There are no special requirements. Students who are interested in startups are preferred.

●Contacting Faculty

Arranging the schedules by e-mail and etc.

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Experiment		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Syusaku NAGANO Associate Professor		

●Course Purpose

To research in advanced engineering, it is necessary to learn the latest research trends through practice. The purpose of this experiment is to find the research issues on one's own and conduct research experiments using the latest experimental equipment and molecular simulation technology.
Through this experiment, you will be able to understand the principles of the Raman spectrometer, ionization potential measurement, X-ray diffraction etc. and molecular simulation software and learn how to use them practically. The goal is to comprehensively acquire the knowledge, skills, and presentation techniques related to advanced experiments necessary for conducting the research that was the subject.

●Prerequisite Subjects

it is advisable to acquire basic knowledge on the subject research.

●Course Topics

When students choose the prepared subject, students perform the curriculum using one of a Raman spectrometer, an ionization potential measurement and an X-ray diffractometer and learn the principles and practical and advanced usage of these equipment. In the case of an experiment proposed by students (original experiment), students proposes a molecular simulation experiment or research using the above-described equipment, and conduct the experiment with the instructor to produce results. Ultimately, students discuss the results, present their results, and learn how to use the advanced equipment and simulation skills.

●Textbook

Distribute as needed. Please check the required documents by yourself.

●Additional Reading

Distribute as needed. Please check the required documents by yourself.

●Grade Assessment

Exercise (50%) and presentation of research results (50%) will be evaluated. Understanding the measurement principle and usage is used as a criterion for acceptance, but the research achievements and new approaches to research are highly evaluated. A score of 60 or more out of 100 is a passing score.

●Notes

No course requirements.

●Contacting Faculty

Arranging the schedules by e-mail and etc.

Introduction to Academic Communication (1.0credits) (コミュニケーション学)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	Graduate Chemistry
	Graduate Chemistry	Automotive Engineering	Automotive Engineering
	Civil and Environmental Engineering Graduate		
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester		
Lecturer	ReikoFURUYA Associate Professor		

●Course Purpose

Students will learn presentation skills for academic purposes, which may include giving academic presentations.
Japanese students are expected to present in English and international students in Japanese in the seventh or eighth class meeting.
By taking this class, students are expected to be able to do the following:
-Give a solid presentation with confidence and without hesitance
-Grasp the characteristics of successful presentations
-Use techniques learned in class in their own presentation

●Prerequisite Subjects

English language classes for Japanese students
Japanese language classes for international students

●Course Topics

(1) Ways to convey messages in presentation
(2) The language of a presentation
(3) Tips for making effective slides
(4) Observation and analysis of video-taped presentation by a past student
(5) Paper vs presentation
(6) Preparation for individual presentation
(7) Individual presentations I

(8) Individual presentations

This course requires students to work outside of the classes for individual presentation.

●Textbook

Handouts will be distributed in class

●Additional Reading

1The Japan Times
2:

●Grade Assessment

Individual presentation: 50%
Active class participation: 50%

Grades: A+: 100%-95%, A: 94%-80%, B: 79%-70%, C: 69%-65%, C-: 64%-60%, F: 59%-0%

Grading will be decided based on the ability to give an effective academic presentation.

●Notes

There are no requirements for taking this class.

●Contacting Faculty

Questions will be answered before class, in class, after class or by e-mail.

Latest Advanced Technology and Tasks in Automobile Engineering (3.0credits) (先端自動車工学特論)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	Automotive Engineering
	Automotive Engineering		
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester		
Lecturer	Yukio ISHIDA Designated Professor		

●Course Purpose

This course is intended to study the latest advanced technology of automobile engineering from top researchers of universities and industries. The topics of lectures are related to almost all fields of automotive industries, such as hibrid cars, electric cars, automated driving and crash safety. It is asle intended to develop the English hearing/speaking ability. The attainment targets are as follows:

1. Understand the latest technology of automotive engineering.
2. Underatand company's automotive production system.
3. Improve English ability in the field of socience and engineering.
4. Strengthen communication skills and presentation skills in English by studying with international students.

●Prerequisite Subjects

lectures related to fundamental physics, mechanical, electrical and information engineering.

●Course Topics

A. Lectures

1. The Car Industry, Market Trend, Circumstance and Its Future.
2. Overview of Automotive Development Process.
3. Observation and Evaluation of Drivers' Behavior Perspective.
4. Car Materials and Processing.
5. Movements and Control of a Car.
6. Safety Engineering for the Prevention of Accidents.
7. Crash Safety.
8. Automobile Embedded Computing System.
9. Wireless Technologies in ITS.

10.Applications of CAE to Vehicle Development.
11.Energy Saving Technology for Automobiles.
12.Automated Driving.
13.Traffic Flow Characteristics.
14.Cars and Roads in Urban Transportation Context.
15.Automobile in Aging Society.
B. Factory Visits
1.Toyota Motors Corp., 2. Mitsubishi Motors Corp., 3. Toyota Boshoku Corp., 4.Suzuki Museum,
5.Toyota Commemorative Museum, 6. Traffic Safety and Environmental Lab.
C. Group Research Project
Several students form one group and each group selects one topic. They investigate and discuss about this topic and make presentations.
After each lecture is finished, read the handout and write a repor about each lecture with your comments.

●Textbook
Handout delivered in each lecture

●Additional Reading
Introduced in the lectures

●Grade Assessment
Evaluation will be based on (a) Discussions in the lectures 20%, (b) report for each lecture 20%, (c) group presentation 30%. and (d) report on research subject 30%. It is necessary to attend factory visits.In each item, the undastanding of the concepts is especially evaluated.
Summing up the all scores from (a) to (d) and the students with evaluation A, B, or C can pass this subject.

●Notes
1. There are limits of enrollment capacity. Full course student limit is about 10. Auditor limit for each lecture is about 10.
2. English ability is checked before accepted as a student.

●Contacting Faculty
Mainly accepted during each lecture. Other general questions are accepted by Professor Yukio Ishida.
<Contact> TEL: 052-747-6797, Email: ishida@nuem.nagoya-u.ac.jp

Advanced Lectures on Scientific English (1.0credits) (科学技術英語特論)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	Automotive Engineering
	Automotive Engineering	Civil and Environmental Engineering Graduate	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	
Lecturer	Part-time Faculty		

●Course Purpose

This is a course to acquire basic skills to summarize research as a paper in English. By the end of the course, students will be able to …
explain the basic structure of science and technology research paper
list essential components of each section of research paper
type short multiple-paragraph essays with appropriate punctuation
orally express logically structured opinion

●Prerequisite Subjects

Various subjects relating to English

●Course Topics

1. Basics of academic writing in English (1)
2. Basic structure of science & technology research paper (1)
3. Writing (1), feedback and opinion exchange
4. Basics of academic writing in English (2)
5. Basic structure of science & technology research paper (2)
6. Writing (2), feedback and opinion exchange
7. Basic structure of science & technology research paper (3)
8. Writing (3), feedback and opinion exchange

Students are expected to spend a few hours each week reviewing key points of the lecture and working on the writing assignment.

●Textbook

None. Students will receive handouts in each class session.

●Additional Reading

Glasman-Deal, H. (2010). Science Research Writing For Non-Native Speakers of English. Imperial College Press.
Swales, J.M. & Feak, C.B. (2012). Academic Writing for Graduate Students. The University of Michigan Press.
Wallwork, A. (2013). English for Academic Research: Grammar, Usage and Style. Springer.
Wallwork, A. (2016). English for Writing Research Papers. Springer.

●Grade Assessment

Submitting three short writing assignments that show understanding of research paper structure with appropriate punctuation is required for a passing grade. Speaking English contributing to discussion and opinion exchange, as well as raising questions in class, is strongly encouraged.

●Notes

There are no prerequisites

●Contacting Faculty

Email address to be announced in the first class

Focus on Venture Business I (2.0credits) (ベンチャービジネス特論 I)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Lecturer	Syusaku NAGANO Associate Professor		

●Course Purpose

People often point out that the layer of startup companies should assume the leading edge is thin. Part of the cause depends on the system, but in many cases, it is due to the difference in perceptions of the entrepreneurship between East and Western researchers. In this course, you study the basic knowledge and goals required as engineers and researchers when commercializing/starting a “university research.” We will show examples of technology development and commercialization based on research results of universities, entrepreneurship in companies and venture startups, and consider venture business utilizing research. Through this lecture, entrepreneurs' mindsets will be formed as well as minimum knowledge of patents.

●Prerequisite Subjects

●Course Topics

●Textbook

Distribute materials as appropriate.

●Additional Reading

●Grade Assessment

Evaluate based on self-made problem report Understanding the problems and solutions for startups that respond to the problems in the lecture is a criterion for success. The contents of the report are comprehensively evaluated, and a score of 60 or more is considered acceptable. New business proposals will be appreciated.

●Notes

Do not have any special requirements. We hope students who are interested in startups.

●Contacting Faculty

the break after the lecture.

Focus on Venture Business II (2.0credits) (ベンチャービジネス特論II)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	
Lecturer	Syusaku NAGANO Associate Professor	Akitoshi EDAGAWA Visiting Professor	

●Course Purpose

By referring to the examples of commercialization, in-company entrepreneurship and venture entrepreneurship given in the special lecture on venture business I, you study the specialized knowledge necessary for entrepreneurship and start-up from a public accountant, SME consultant, etc. Talks are held with specialists in Japan to acquire the knowledge needed for venture business management.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Ethics and Security in Engineering (2.0credits) (工学のセキュリティと倫理)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
	Department of Energy Engineering	Department of Applied Energy	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Tatsuya SUZUKI Professor		

●Course Purpose

The aim of the lecture is to understand ethics, intellectual property rights, information security required at the start of master thesis research. After taking this course, the students are expected to have abilities on:

1. Understanding of Ethics for engineers
2. Understanding of Ethics for researcher
3. Understanding of Intellectual property rights
4. Understanding of Information security

●Prerequisite Subjects

None because this is one of the common basic subject for future activity as a researcher or an engineer.

●Course Topics

1) Introduction,
2)Ethics for engineers,
3)Ethics for researchers,
4)Intellectual property rights,
5)Information security,
6)Summary

Submission of the report after each class is mandatory.

●Textbook

Instead of using textbook, original lecture notes will be provided at each class.

●Additional Reading

Original lecture notes will be provided at each class.

●Grade Assessment

Credits will be awarded to those students who score 'Pass' based on the reports and /or subjects given by each lecture.

●Notes

None because this is one of the common basic subject for future activity as a researcher or an engineer.

●Contacting Faculty

After each class student can ask in person.
Otherwise, contact to:

Pro. Suzuki
Ext. 2700, t_suzuki@nuem.nagoya-u.ac.jp

Internship A (1.0credits) (学外実習Ａ)

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Associated Faculty

●Course Purpose
Students are dispatched to the research and development department of a cooperating company and engage in research and development work on a predetermined theme for a predetermined period of time, thereby learning how to set and solve technical issues at the company. Through this experience, students acquire practical abilities and broad insight.

●Prerequisite Subjects
Subjects related to Applied Physics

●Course Topics
The research content is determined based on the agreement between the the company staff and the students.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on oral presentation and report.(Evaluation criteria)Passing grade: 60 points out of 100

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome within or after each class.

Internship B (1.0credits) (学外実習Ｂ)

Course Type	Comprehensive engineering courses
Division at course	Master's Course
Class Format	Practice
Course Name	Applied Physics
Starts 1	1 Spring and Autumn Semester
Lecturer	Associated Faculty

●Course Purpose
Students are dispatched to the research and development department of a cooperating company and engage in research and development work on a predetermined theme for a predetermined period of time, thereby learning how to set and solve technical issues at the company. Through this experience, students acquire practical abilities and broad insight.

●Prerequisite Subjects
Subjects related to Applied Physics

●Course Topics
The research content is determined based on the agreement between the the company staff and the students.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on oral presentation and report.(Evaluation criteria)Passing grade: 60 points out of 100

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome within or after each class.

Overview of space exploration and research (2.0credits) (宇宙研究開発概論)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Process Engineering
	Chemical Systems Engineering	Electrical Engineering	Electronics
	Information and Communication Engineering	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering
	Aerospace Engineering	Department of Energy Engineering	Department of Applied Energy
	Civil and Environmental Engineering		
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester		
Lecturer	Leading Graduate		

●Course Purpose

This lecture course helps students to acquire a wide-ranging, panoramic knowledge of space research and development given by variety of lecturers from different academic fields.

●Prerequisite Subjects

Basic mathematics, Basic physics

●Course Topics

1. Space Exploration Projects
1.1 Overview of Space Exploration and Research
1.2 Space Projects
1.3 International Satellite and Spacecraft (HTV) Development
1.4 Project Management/Systems Engineering
1.5 Intelectual Properties in Business

2. Space Explorations on Observations
2.1 Space Propulsion Engineering
2.2 Materials Development for Space Applications
2.3 Space Observation Technologies
2.4 Introduction to Radiation Detectors and Electronics

3. Space-related Science
3.1 Foundations of Astrophysics
3.2 Earth and Planetary Science
3.3 Space Environment Science
3.4 Simulation Experiments

Report subject will be given at every lecture. The report should be submitted by the given deadline.

●Textbook

We do not specify the textbook. Lecture notes will be given as necessary.

●Additional Reading

Recommended readings will be give during lectures as necessary.

●Grade Assessment

Report must be submitted for each lecture. Proper understanding of each lecture's contents is evaluated. Passing average point is 60 out of 100.

●Notes

Students in "Leadership program for Space exploration and Research" are required to take this course before the qualifying examination. This course is open to any graduate students in Nagoya University.

●Contacting Faculty

Inquire contact method from the lecturer after the lecture

Advanced Mobility Program Basic Course (4.0credits) (先進モビリティ学基礎)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture and Exercise		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Lecturer	Faculty of Advanced Mobility Program		

●Course Purpose

To train students who can be active in the mobility industry or research institute. This course is aiming to cultivate comprehensive knowledge not only on specialized technical elements but also service and social impact of the mobility. The class will be provided not only by professors but also by engineers in industry. The course is organized as follows:

1. Understand fundamentals of automobile
2. Understand the trend on electrification of automobile
3. Understand the trend on on intelligence for automobile
4. Understand dependability, safety and human factor
5. Comprehensively study the mobility service
6. Comprehensively study the legal system for mobility

●Prerequisite Subjects

Accepted basic engineering classes at Nagoya University Bachelor's degree, or equivalent knowledge.

●Course Topics

1. Fundamentals of automobile
2. Electrification of automobile
3. Intelligence for automobile
4. Dependability, safety and human factor
5. Mobility service
6. Legal system for mobility
7. Discussion and presentation

Read carefully the textbook before attending each class. After each class, solving the exercises in the

textbook is highly recommended. Submission of the report after each class is mandatory.

●Textbook
Original lecture note will be provided.

●Additional Reading
It will be announced in the class if necessary.

●Grade Assessment
Evaluation is based on total score of reports at each class and final presentation. You need more than mark of 60 out of 100 points. Special certificate will be provided for passed students.

●Notes
No particular requirement.

●Contacting Faculty
Office hour:Wed.13:0014:00 @Green Vehicle Material Research Building 1F
Mail to: o_shimizu@nuem.nagoya-u.ac.jp

ced Mobility Program Practical Training Course(Autonomous Vehicle) (2.0credits) (先進モビリティ学実習（自動運

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Exercise and Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	
Lecturer	Faculty of Advanced Mobility Program		

●Course Purpose

To train students who can be active in the mobility industry or research institute. This course is aiming to realization of autonomous drive by using 1/10 model car. Students develop the software system for autonomous driving. The course is organized as follows:

1. Understand architecture of autonomous drive
2. Understand the image processing for lane detection, and its implementation
3. Understand the control technique for lane following and its implementation

●Prerequisite Subjects

Accepted basic engineering classes at Nagoya University Bachelor's degree, or equivalent knowledge.

●Course Topics

This course is aiming to realization of autonomous drive by using 1/10 model car. Students develop the software system for autonomous driving. The course is organized as follows:

1. Architecture of autonomous drive
2. Image processing for lane detection, and its implementation
3. Control technique for lane following and its implementation

Class is performed based on group activity.

●Textbook

Original lecture note will be provided.

●Additional Reading

It will be announced in the class if necessary.

ced Mobility Program Practical Training Course(Autonomous Vehicle) (2.0credits) (先進モビリティ学実習（自動運

●Grade Assessment

Evaluate based on attendance at lecture, total score of tasks set at each time, final presentation. Special certificate will be provided for passed students.

●Notes

No particular requirement

●Contacting Faculty

Office hour:Wed.13:0014:00 @Green Vehicle Material Research Building 1F
Mail to: o_shimizu@nuem.nagoya-u.ac.jp

dvanced Mobility Program Practical Training Course(Electric Vehicle) (2.0credits) (先進モビリティ学実習（ＥＶ）

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Exercise and Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
	1 Autumn Semester	1 Autumn Semester	
Lecturer	Faculty of Advanced Mobility Program		

●Course Purpose

To train students who can be active in the mobility industry or research institute. This course is aiming to design and analysis of EV formula car. In addition, Test drive is carried out. The course is organized as follows:1. Understand the mechanism of electric vehicle2. Understand the characteristics of motor and battery3. Understand the way of analysis and design of vehicle

●Prerequisite Subjects

Accepted basic engineering classes at Nagoya University Bachelor's degree, or equivalent knowledge.

●Course Topics

This course is aiming to design and analysis of EV formula car. In addition, Test drive is carried out. The course is organized as follows:1. Mechanism of electric vehicle2. Characteristics of motor and battery3. Way of analysis and design of vehicle Class is performed based on group activity.

●Textbook

Original lecture note will be provided.

●Additional Reading

It will be announced in the class if necessary.

●Grade Assessment

Evaluate based on attendance at lecture, total score of tasks set at each time, final presentation. You need more than mark of 60 out of 100 points. Special certificate will be provided for passed students.

●Notes

No particular requirement

●Contacting Faculty

Office hour:Wed.13:0014:00 @Green Vehicle Material Research Building 1FMail to: o_shimizu@nuem.nagoya-u.ac.jp

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

• To design and conduct an original research project
• To develop experience with experimental/numerical/theoretical techniques
• To develop a working knowledge of relevant research literature
• To practice scientific writing and participate in the peer review process
• To be able to discuss the research and topic with other scientists and engineers
The objective of this project is to increase the capability to find and to solve research problems by learning the research approaches and ideas of different research fields.

●Prerequisite Subjects

Basic engineering subjects, English, Technical English

●Course Topics

• Students will develop (with guidance) a research project proposal at the beginning of the semester that will provide initiative, outline and experimental strategy.
• Each student will present oral reports of research progress, relevant readings, and/or challenges at scheduled lab meetings.
• Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. This is a lab course and you are expected to spend a minimum of 20 hours of productive lab work per week. It is more realistic to expect to spend an average of 25-30 hours per week working and thinking about your project.
• Students will produce a manuscript (with active feedback from the instructor and peers) that can be published in part or whole by a peer reviewed research journal. Publishable manuscripts require many drafts,

reviews, and revisions.
• Students are encouraged to present research results at appropriate scientific meetings.
• Students well be self-motivated and work independently, approaching the instructor for guidance regularly.

●Textbook
Will be designated by each supervisor.

●Additional Reading
Will be designated by each supervisor.

●Grade Assessment
The grade will be calculated according to the following criteria.
Written report following the same format as scientific paper... 50%; Presentation at the Workshop... 50%.
The acceptance standard is to understand the introduced research approaches and ideas.
Evaluation is done by the supervisor(s) at home and visiting universities.

●Notes
No conditions for taking the course

●Contacting Faculty
Supervisor of visiting university basically takes care.

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

• To design and conduct an original research project
• To develop experience with experimental/numerical/theoretical techniques
• To develop a working knowledge of relevant research literature
• To practice scientific writing and participate in the peer review process
• To be able to discuss the research and topic with other scientists and engineers
The objective of this project is to increase the capability to find and to solve research problems by learning the research approaches and ideas of different research fields.

●Prerequisite Subjects

Basic engineering subjects, English, Technical English

●Course Topics

• Students will develop (with guidance) a research project proposal at the beginning of the semester that will provide initiative, outline and experimental strategy.
• Each student will present oral reports of research progress, relevant readings, and/or challenges at scheduled lab meetings.
• Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. This is a lab course and you are expected to spend a minimum of 20 hours of productive lab work per week. It is more realistic to expect to spend an average of 25-30 hours per week working and thinking about your project.
• Students will produce a manuscript (with active feedback from the instructor and peers) that can be published in part or whole by a peer reviewed research journal. Publishable manuscripts require many drafts,

reviews, and revisions.
• Students are encouraged to present research results at appropriate scientific meetings.
• Students well be self-motivated and work independently, approaching the instructor for guidance regularly.

●Textbook

Will be designated by each supervisor.

●Additional Reading

Will be designated by each supervisor.

●Grade Assessment

The grade will be calculated according to the following criteria.
Written report following the same format as scientific paper... 50%; Presentation at the Workshop... 50%.
The acceptance standard is to understand the introduced research approaches and ideas.
Evaluation is done by the supervisor(s) at home and visiting universities.

●Notes

No conditions for taking the course

●Contacting Faculty

Supervisor of visiting university basically takes care.

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

• To design and conduct an original research project
• To develop experience with experimental/numerical/theoretical techniques
• To develop a working knowledge of relevant research literature
• To practice scientific writing and participate in the peer review process
• To be able to discuss the research and topic with other scientists and engineers
The objective of this project is to increase the capability to find and to solve research problems by learning the research approaches and ideas of different research fields.

●Prerequisite Subjects

Basic engineering subjects, English, Technical English

●Course Topics

• Students will develop (with guidance) a research project proposal at the beginning of the semester that will provide initiative, outline and experimental strategy.
• Each student will present oral reports of research progress, relevant readings, and/or challenges at scheduled lab meetings.
• Students will take primary responsibility for conducting research and do so with professional attitudes and time commitments. This is a lab course and you are expected to spend a minimum of 20 hours of productive lab work per week. It is more realistic to expect to spend an average of 25-30 hours per week working and thinking about your project.
• Students will produce a manuscript (with active feedback from the instructor and peers) that can be published in part or whole by a peer reviewed research journal. Publishable manuscripts require many drafts,

reviews, and revisions.
• Students are encouraged to present research results at appropriate scientific meetings.
• Students well be self-motivated and work independently, approaching the instructor for guidance regularly.

●Textbook
Will be designated by each supervisor.

●Additional Reading
Will be designated by each supervisor.

●Grade Assessment
The grade will be calculated according to the following criteria.
Written report following the same format as scientific paper... 50%; Presentation at the Workshop... 50%.
The acceptance standard is to understand the introduced research approaches and ideas.
Evaluation is done by the supervisor(s) at home and visiting universities.

●Notes
No conditions for taking the course

●Contacting Faculty
Supervisor of visiting university basically takes care.

International special lecture (1.0credits) (国際協働教育特別講義)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Lecture		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Process Engineering
	Chemical Systems Engineering	Electrical Engineering	Electronics
	Information and Communication Engineering	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering
	Aerospace Engineering	Department of Energy Engineering	Department of Applied Energy
	Civil and Environmental Engineering		
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester		
Lecturer	Associated Faculty		

●Course Purpose

Gain basic knowledge of general engineering through English lectures on various hot research topics and leading technologies. The objective of this lecture is to develop research abilities and communication skills, which are essential to carry out international collaborative researches.

●Prerequisite Subjects

Basic engineering subjects, English, Technical English

●Course Topics

Depends on the lecturer.This course will be divided in 4 chapters as follows:1. Setting theme and reviewing literature2. Designing research plan3. Analysis and discussion of results4. Brief summary and future prospectsHomework will be given after the class and the report is required to be submitted in next class.

●Textbook

Will be designated by the lecturer.

●Additional Reading

Will be designated by the lecturer.

●Grade Assessment

Written report and evaluation by the professors.

●Notes

No conditions for taking the course

●Contacting Faculty

In the class and E-mail.

International language exercise (1.0credits) (国際協働教育外国語演習)

Course Type	Comprehensive engineering courses		
Division at course	Master's Course		
Class Format	Exercise		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Process Engineering
	Chemical Systems Engineering	Electrical Engineering	Electronics
	Information and Communication Engineering	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering
	Aerospace Engineering	Department of Energy Engineering	Department of Applied Energy
	Civil and Environmental Engineering		
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester		
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to provide Japanese students with the English classes or provide international students with Japanese classes to improve communication skills for both academic and daily life.

●Prerequisite Subjects

English, Technical English, Japanese

●Course Topics

Wide variety of exercises including speaking, listening, writing, reading, and presentation in Japanese/English.Homework will be given after the class and the report is required to be submitted in next class.

●Textbook

Will be designated by the lecturer.

●Additional Reading

Will be designated by the lecturer.

●Grade Assessment

Report, presentation, participation in discussionGrading will be based on understanding Japanese and English, and communication performance.

●Notes

No conditions for taking the course

●Contacting Faculty

Acceptance and response in the class or through E-mail.

Seminar on Solid State Engineering 2A (2.0credits) (物性基礎工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

Students master the fundamental basis and the ability of application of condensed matter physics like superconductivity, topological quantum phenomena, cold atom, mono-layer material fractional quantum Hall effect and spintronics.
For given theme on condensed matter theory, students make research on the problem and cultivate ablitiy to develop an original field of science.

Purposes:
1. To find research problems in the field of condensed mater theory.
2. To cultivate wide knowledge on condensed matter theory.

Example of the topics:
- Superconducting JunctionsTunnel effet, Josephson effect, Proximity effect
- Topological Superconductors
- Cold atom
- Skyrmion
- Topological Insulators
- Fractional quantum Hall effect
- Spintronics
- Symmetry of superconductivity
- Mechanism of Superconductivity
- Majorana Braiding Dynamics
- Atomic monolayers (Graphene, Silicene, Stanene)
- Dirac Semimetal, Weyl Semimetal

●Prerequisite Subjects

Seminar on Solid State Engineering 1A-1D

●Course Topics

Students select problems in the field of solid state theory and learn how to make reserach.

●Textbook

None

●Additional Reading

[1]Tunnelling effects on surface bound states in unconventional superconductors, S. Kasiwaya and Y. Tanaka, Rep. Prog. Phys. 63 1641(2000).
[2]The current-phase relation in Josephson junctions A. Golubov, A. A. Golubov, M. Yu. Kupriyanov, and E. Il’ichev, Rev. Mod. Phys. 76, 411 (2004)
[3]Spinor Bose-Einstein condensate, Y. Kawaguchi and M. Ueda, Physics Reports 520, 253-381 (2012)
D1,D2

●Grade Assessment

report and Oral presentation

●Notes

Basics of quantum statistical physics and condensed matter physics

●Contacting Faculty

After the seminar, Discussion time

Seminar on Solid State Engineering 2B (2.0credits) (物性基礎工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

Students master the fundamental basis and the ability of application of condensed matter physics like superconductivity, topological quantum phenomena, cold atom, mono-layer material and spintronics.
For given theme on condensed matter theory, students make research on the problem and cultivate ablitiy to develop an original field of science.

Purposes:
1. To find research problems in the field of condensed mater theory.
2. To cultivate wide knowledge on condensed matter theory.

Exampleoftopics:
- Superconducting JunctionsTunnel effect, Josephson effect, Proximity effect
- Topological Superconductors
- Cold atom
- Skyrmion
- Topological Insulators
- Spintronics
- Symmetry of superconductivity
- Mechanism of Superconductivity
- Majorana Braiding Dynamics
- Atomic monolayers (Graphene, Silicene, Stanene)
- Dirac Semimetal, Weyl Semimetal

●Prerequisite Subjects

Seminar on Solid State Engineering 1A-1D & 2A

●Course Topics

Students select problems in the field of solid state theory and learn how to make reserach.

●Textbook

None

●Additional Reading

None

●Grade Assessment

Reports and oral examination

●Notes

●Contacting Faculty

After the seminar, Discussion time

Seminar on Solid State Engineering 2C (2.0credits) (物性基礎工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

Students master the fundamental basis and the ability of application of condensed matter physics like superconductivity, topological quantum phenomena, cold atom, mono-layer material and spintronics. For given subjects on solid state theory, students make research on the problem and cultivate ablitiy to develop an original field of science.

Purposes:
1. To find research problems in the field of solid state theory.
2. To cultivate wide knowledge on solid state theory.

Example of the topics:
- Superconducting JunctionsTunnel effet, Josephson effect, Proximity effect
- Topological Superconductors
- Cold atom
- Skyrmion
- Topological Insulators
- Spintronics
- Symmetry of superconductivity
- Mechanism of Superconductivity
- Majorana Braiding Dynamics
- Atomic monolayers (Graphene, Silicene, Stanene)
- Dirac Semimetal, Weyl Semimetal

●Prerequisite Subjects

Seminar on Solid State Engineering 1A-1D & 2A-2B

●Course Topics

Students select problems in the field of solid state theory and learn how to make reserach.

●Textbook

Not specified

●Additional Reading

"Symmetry and Topology in Superconductors –Odd-Frequency Pairing and Edge States–", Y. Tanaka, M. Sato and N. Nagaosa, J. Phys. Soc. Jpn. 81 011013 (2013).
"Topological superconductors": a review, M. Sato and Y. Ando, Rep. Prog. Phys. 80 076501, (2017).
"Spinor Bose-Einstein condensate", Y. Kawaguchi and M. Ueda, Physics Reports 520, 253-381 (2012).
Field Theories of Condensed Matter Physics, (E. Fradkin), Cambridge
Quantum Physics in One dimension Thierry Giamarchi (Oxford Science Publications)
Quantum Field Theory of Many-Body Systems, Siao-Gang Wen (Oxford university press)

●Grade Assessment

Report Oral Presentation

●Notes

Basics of quantum statistical physics and condensed matter physics

●Contacting Faculty

After the seminar, Discussion time

Seminar on Solid State Engineering 2D (2.0credits) (物性基礎工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

Students master the fundamental basis and the ability of application of condensed matter physics like superconductivity, topological quantum phenomena, cold atom, mono-layer material and spintronics. For given subjects on solid state theory, students make research on the problem and cultivate ablitiy to develop an original field of science.

Purposes:
1. To find research problems in the field of solid state theory.
2. To cultivate wide knowledge on solid state theory and avility to communicate with other scientists.

Example of the topics:
- Superconducting JunctionsTunnel effet, Josephson effect, Proximity effect
- Topological Superconductors
- Cold atom
- Skyrmion
- Topological Insulators
- Spintronics
- Symmetry of superconductivity
- Mechanism of Superconductivity
- Majorana Braiding Dynamics
- Atomic monolayers (Graphene, Silicene, Stanene)
- Dirac Semimetal, Weyl Semimetal

●Prerequisite Subjects

Seminar on Solid State Engineering 1A-1D & 2A-2C

●Course Topics

Students select problems in the field of solid state theory and learn how to make reserach.

●Textbook

Not specified

●Additional Reading

"Tunnelling effects on surface bound states in unconventional superconductors", S. Kasiwaya and Y. Tanaka, Rep. Prog. Phys. 63 1641(2000).
"The current-phase relation in Josephson junctions", A. Golubov, A. A. Golubov, M. Yu. Kupriyanov, and E. Il’ichev, Rev. Mod. Phys. 76, 411 (2004)
"Symmetry and Topology in Superconductors –Odd-Frequency Pairing and Edge States–", Y. Tanaka, M. Sato and N. Nagaosa, J. Phys. Soc. Jpn. 81 011013 (2013).
"Spinor Bose-Einstein condensate", Y. Kawaguchi and M. Ueda, Physics Reports 520, 253-381 (2012).
Field Theories of Condensed Matter Physics, (E. Fradkin), Cambridge
Quantum Physics in One dimension Thierry Giamarchi (Oxford Science Publications)
Quantum Field Theory of Many-Body Systems, Siao-Gang Wen (Oxford university press)

●Grade Assessment

Reports and oral examination

●Notes

Basics of quantum statistical physics and condensed matter physics

●Contacting Faculty

After the seminar, Discussion time

Seminar on Solid State Engineering 2E (2.0credits) (物性基礎工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Yukio TANAKA Professor	YukiKAWAGUCHI Associate Professor	Keiji YADA Assistant Professor
	KazuyaFUJIMOTO Designated Assistant Professor		

●Course Purpose

For given subjects on solid state theory, students make research on the problem and cultivate ability to develop an original field of science.

Purposes:
1. To find research problems in the field of solid state theory.
2. To cultivate wide knowledge on solid state theory.
3. To present obtained results.

Example of the topics:
- Superconducting JunctionsTunnel effet, Josephson effect, Proximity effect
- Topological Superconductors
- Cold atom
- Skyrmion
- Topological Insulators
- Spintronics
- Symmetry of superconductivity
- Mechanism of Superconductivity
- Majorana Braiding Dynamics
- Atomic monolayers (Graphene, Silicene, Stanene)
- Dirac Semimetal, Weyl Semimetal

●Prerequisite Subjects

Seminar on Solid State Engineering 1A-1D & 2A-2D

●Course Topics

Students select problems in the field of solid state theory and learn how to make reserach.

●Textbook

None

●Additional Reading

"Symmetry and Topology in Superconductors –Odd-Frequency Pairing and Edge States–", Y. Tanaka, M. Sato and N. Nagaosa, J. Phys. Soc. Jpn. 81 011013 (2012).
"Topological superconductors": a review, M. Sato and Y. Ando, Rep. Prog. Phys. 80 076501, (2017).
"Spinor Bose-Einstein condensate", Y. Kawaguchi and M. Ueda, Physics Reports 520, 253-381 (2012).
Field Theories of Condensed Matter Physics, (E. Fradkin), Cambridge
Quantum Physics in One dimension Thierry Giamarchi (Oxford Science Publications)
Quantum Field Theory of Many-Body Systems, Siao-Gang Wen (Oxford university press)

●Grade Assessment

Reports and oral examination

●Notes

Basics of quantum statistical physics and condensed matter physics

●Contacting Faculty

After the seminar, Discussion time

Seminar on Optical Science and Engineering 2A (2.0credits) (光物理工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Seminar on electronic and optical properties of condensed matter and nanoscience.
Through the below learning, acquire the knowledge and applied and integration skills for advanced studies and the creative minds to lay out a research plan.

Goal of study:
1. Acquire the ability to plan a new research based on the understanding of the frontier research.
2. Acquire the ability to introduce and discuss the content of English papers.
3. Acquire the knowledge of wide range of condensed matter physics, material sciences and nanosciences.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 2B (2.0credits) (光物理工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Seminar on electronic and optical properties of condensed matter and nanoscience.
Through the below learning, acquire the knowledge and applied and integration skills for advanced studies and the creative minds to lay out a research plan.

Goal of study:
1. Acquire the ability to plan a new research based on the understanding of the frontier research.
2. Acquire the ability to introduce and discuss the content of English papers.
3. Acquire the knowledge of wide range of condensed matter physics, material sciences and nanosciences.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 2C (2.0credits) (光物理工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Seminar on electronic and optical properties of condensed matter and nanoscience.
Through the below learning, acquire the knowledge and applied and integration skills for advanced studies and the creative minds to lay out a research plan.

Goal of study:
1. Acquire the ability to plan a new research based on the understanding of the frontier research.
2. Acquire the ability to introduce and discuss the content of English papers.
3. Acquire the knowledge of wide range of condensed matter physics, material sciences and nanosciences.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 2D (2.0credits) (光物理工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Seminar on electronic and optical properties of condensed matter and nanoscience.
Through the below learning, acquire the knowledge and applied and integration skills for advanced studies and the creative minds to lay out a research plan.

Goal of study:
1. Acquire the ability to plan a new research based on the understanding of the frontier research.
2. Acquire the ability to introduce and discuss the content of English papers.
3. Acquire the knowledge of wide range of condensed matter physics, material sciences and nanosciences.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Optical Science and Engineering 2E (2.0credits) (光物理工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Hideo KISHIDA Professor	Takeshi KOYAMA Associate Professor	Yuto NAKAMURA Assistant Professor

●Course Purpose

Seminar on electronic and optical properties of condensed matter and nanoscience.
Through the below learning, acquire the knowledge and applied and integration skills for advanced studies and the creative minds to lay out a research plan.

Goal of study:
1. Acquire the ability to plan a new research based on the understanding of the frontier research.
2. Acquire the ability to introduce and discuss the content of English papers.
3. Acquire the knowledge of wide range of condensed matter physics, material sciences and nanosciences.

●Prerequisite Subjects

Quantum Mechanics, Optics, Solid State Physics

●Course Topics

1. Optical Properties of Condensed Matter 2. Electronic Properties of Condensed Matter 3. Nanoscience 4. Nonlinear Optics 5. Laser Spectroscopy

Literature introduction and discussions about the above topics.

●Textbook

We choose papers from international journals.

●Additional Reading

We will introduce appropriate references as needed.

●Grade Assessment

Presentations, presentation materials and discussions. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can ask questions in the seminar. Otherwise, contact the instructors.

Seminar on Quantum Physics in Condensed Matter 2A (2.0credits) (量子物性工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 2B (2.0credits) (量子物性工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 2C (2.0credits) (量子物性工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 2D (2.0credits) (量子物性工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%) and question and answer (40%).

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Quantum Physics in Condensed Matter 2E (2.0credits) (量子物性工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Taishi TAKENOBU Professor	Hiroshi ITO Associate Professor	Hisaaki TANAKA Assistant Professor
	PU Jiang Assistant Professor		

●Course Purpose

Through seminars on recent papers or monographs of pi-electron materials, such as organic molecules, nano-carbon materials, and atomically thin materials, students learn attitudes against academic research; the basics for research techniques and application to specific problems.
Through these activities, students acquire creativity and overall ability for solving specific problems.

●Prerequisite Subjects

Quantum physics, statistic thermodynamics, electromagnetism, solid state physics, chemical physics

●Course Topics

1. Organic laser devices
2. Ion-driven novel functional devices
3. Valleytronics based on atomically thin materials
4. Electron spin resonance study of structure and property of organic solids
5. Electrical conduction and superconductivity of organic solids.

Preparation for each subject should be made beforehand.

●Textbook

To be designated.

●Additional Reading

To be designated.

●Grade Assessment

Evaluation by oral examinations (60%%) and question and answer (40%%).:

●Notes

No requirement

●Contacting Faculty

Quentions are acceptable at the seminar.

Seminar on Structural Materials Science and Engineering 2A (2.0credits) (構造物性工学セミナー2A)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	1 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on structure engineering deals with advanced studies of microstructure of crystalline materials. It is composed of a series of 6 seminars, that is, seminar on structure engineering 2A to 2E. Through the whole seminars, it is aimed to develop the students' abilities to progress their PhD theses by solving small problems in microstructure engineering.

The aims of the class is below,
1. Understanding of the structural research, 2. Understanding of the classical technique of the structural research, 3. Understanding of the structural analysis technique such as X-ray diffraction, 4. Learning of the recent experimental/analytical technique, 5. Understanding of the structural research based from the structural physics point of view, 6. Investigating his/her own theme and make a thesis.

●Prerequisite Subjects

Solid State Physics, Diffraction Physics, Synchrotron Radiation Science, Statistical Mechanics, Quantum Physics, Materials Science

●Course Topics

The small theme in structure engineering will be given to each student. He(she) has to consider his(her) own theme in advance, and get the answers. Following to the presentation of the answers, the discussion with staff members is necessity.

Through the 5 classes consisting of 2A to 2E, we require students to understand below,
1. Importance of understanding of the crystal structures, 2. What decides the physical properties, 3. Physical properties sensitive to the crystal structure, 4. Physical properties insensitive to the crystal structure, 5. Relationship between structure and physical properties.

●Textbook

Original papers. The advices will be given concerning which papers would be appropriate to read.

●Additional Reading

Electronic Structure and the Properties of Soids ,by W.A.Harrison,Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel,

●Grade Assessment

Oral examinations and reports.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 2B (2.0credits) (構造物性工学セミナー2B)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	1 Autumn Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on structure engineering deals with advanced studies of microstructure of crystalline materials. It is composed of a series of 6 seminars, that is, seminar on structure engineering 2A to 2E. Through the whole seminars, it is aimed to develop the students' abilities to progress their PhD theses by solving small problems in microstructure engineering.

The aims of the class is below,
1. Understanding of the structural research, 2. Understanding of the classical technique of the structural research, 3. Understanding of the structural analysis technique such as X-ray diffraction, 4. Learning of the recent experimental/analytical technique, 5. Understanding of the structural research based from the structural physics point of view, 6. Investigating his/her own theme and make a thesis.

●Prerequisite Subjects

Solid State Physics, Diffraction Physics, Synchrotron Radiation Science, Statistical Mechanics, Quantum Physics, Materials Science

●Course Topics

The small theme in structure engineering will be given to each student. He(she) has to consider his(her) own theme in advance, and get the answers. Following to the presentation of the answers, the discussion with staff members is necessity.

Through the 5 classes consisting of 2A to 2E, we require students to understand below,
1. Importance of understanding of the crystal structures, 2. What decides the physical properties, 3. Physical properties sensitive to the crystal structure, 4. Physical properties insensitive to the crystal structure, 5. Relationship between structure and physical properties.

●Textbook

Original papers. The advices will be given concerning which papers would be appropriate to read.

●Additional Reading

Electronic Structure and the Properties of Soids ,by W.A.Harrison,Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel,

●Grade Assessment

Oral examinations and reports.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 2C (2.0credits) (構造物性工学セミナー2C)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	2 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on structure engineering deals with advanced studies of microstructure of crystalline materials. It is composed of a series of 6 seminars, that is, seminar on structure engineering 2A to 2E. Through the whole seminars, it is aimed to develop the students' abilities to progress their PhD theses by solving small problems in microstructure engineering.

The aims of the class is below,
1. Understanding of the structural research, 2. Understanding of the classical technique of the structural research, 3. Understanding of the structural analysis technique such as X-ray diffraction, 4. Learning of the recent experimental/analytical technique, 5. Understanding of the structural research based from the structural physics point of view, 6. Investigating his/her own theme and make a thesis.

●Prerequisite Subjects

Solid State Physics, Diffraction Physics, Synchrotron Radiation Science, Statistical Mechanics, Quantum Physics, Materials Science

●Course Topics

The small theme in structure engineering will be given to each student. He(she) has to consider his(her) own theme in advance, and get the answers. Following to the presentation of the answers, the discussion with staff members is necessity.

Through the 5 classes consisting of 2A to 2E, we require students to understand below,
1. Importance of understanding of the crystal structures, 2. What decides the physical properties, 3. Physical properties sensitive to the crystal structure, 4. Physical properties insensitive to the crystal structure, 5. Relationship between structure and physical properties.

●Textbook

Original papers. The advices will be given concerning which papers would be appropriate to read.

●Additional Reading

Electronic Structure and the Properties of Soids ,by W.A.Harrison,Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel,

●Grade Assessment

Oral examinations and reports.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 2D (2.0credits) (構造物性工学セミナー2D)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	2 Autumn Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on structure engineering deals with advanced studies of microstructure of crystalline materials. It is composed of a series of 6 seminars, that is, seminar on structure engineering 2A to 2E. Through the whole seminars, it is aimed to develop the students' abilities to progress their PhD theses by solving small problems in microstructure engineering.

The aims of the class is below,
1. Understanding of the structural research, 2. Understanding of the classical technique of the structural research, 3. Understanding of the structural analysis technique such as X-ray diffraction, 4. Learning of the recent experimental/analytical technique, 5. Understanding of the structural research based from the structural physics point of view, 6. Investigating his/her own theme and make a thesis.

●Prerequisite Subjects

Solid State Physics, Diffraction Physics, Synchrotron Radiation Science, Statistical Mechanics, Quantum Physics, Materials Science

●Course Topics

The small theme in structure engineering will be given to each student. He(she) has to consider his(her) own theme in advance, and get the answers. Following to the presentation of the answers, the discussion with staff members is necessity.

Through the 5 classes consisting of 2A to 2E, we require students to understand below,
1. Importance of understanding of the crystal structures, 2. What decides the physical properties, 3. Physical properties sensitive to the crystal structure, 4. Physical properties insensitive to the crystal structure, 5. Relationship between structure and physical properties.

●Textbook

Original papers. The advices will be given concerning which papers would be appropriate to read.

●Additional Reading

Electronic Structure and the Properties of Soids ,by W.A.Harrison,Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel,

●Grade Assessment

Oral examinations and reports.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Structural Materials Science and Engineering 2E (2.0credits) (構造物性工学セミナー2E)

Course Type	Specialized Courses	
Division at course	Doctor's Course	
Class Format	Seminar	
Course Name	Applied Physics	
Starts 1	3 Spring Semester	
Lecturer	Hiroshi SAWA Professor	Naoyuki KATAYAMA Associate Professor

●Course Purpose

The seminar on structure engineering deals with advanced studies of microstructure of crystalline materials. It is composed of a series of 6 seminars, that is, seminar on structure engineering 2A to 2E. Through the whole seminars, it is aimed to develop the students' abilities to progress their PhD theses by solving small problems in microstructure engineering.

The aims of the class is below,
1. Understanding of the structural research, 2. Understanding of the classical technique of the structural research, 3. Understanding of the structural analysis technique such as X-ray diffraction, 4. Learning of the recent experimental/analytical technique, 5. Understanding of the structural research based from the structural physics point of view, 6. Investigating his/her own theme and make a thesis.

●Prerequisite Subjects

Solid State Physics, Diffraction Physics, Synchrotron Radiation Science, Statistical Mechanics, Quantum Physics, Materials Science

●Course Topics

The small theme in structure engineering will be given to each student. He(she) has to consider his(her) own theme in advance, and get the answers. Following to the presentation of the answers, the discussion with staff members is necessity.

Through the 5 classes consisting of 2A to 2E, we require students to understand below,
1. Importance of understanding of the crystal structures, 2. What decides the physical properties, 3. Physical properties sensitive to the crystal structure, 4. Physical properties insensitive to the crystal structure, 5. Relationship between structure and physical properties.

●Textbook

Original papers. The advices will be given concerning which papers would be appropriate to read.

●Additional Reading

Electronic Structure and the Properties of Soids ,by W.A.Harrison,Synchrotron Radiation Crystallography by P.Coppens, Introduction to Solid State Physics by C. Kittel,

●Grade Assessment

Oral examinations and reports.

●Notes

No course requirements

●Contacting Faculty

Correspond at the time of the seminar.

Seminar on Magnetic Materials Engineering2A (2.0credits) (磁性材料工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.

Goals:

1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering2B (2.0credits) (磁性材料工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.
Goals:
1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminar on Magnetic Materials Engineering 2A

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminar on Magnetic Materials Engineering 2A.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering2C (2.0credits) (磁性材料工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.

Goals:

1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminars on Magnetic Materials Engineering 2A and 2B

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminars on Magnetic Materials Engineering 2A and 2B.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering2D (2.0credits) (磁性材料工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.

Goals:

1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminars on Magnetic Materials Engineering 2A, 2B, and 2C.

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminars on Magnetic Materials Engineering 2A, 2B, and 2C.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Magnetic Materials Engineering2E (2.0credits) (磁性材料工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	TAKENAKAKoshi Professor	Yoshihiko OKAMOTO Associate Professor	Yasunori YOKOYAMA Assistant Professor

●Course Purpose

This seminar aims to acquire knowledge on physical and chemical backgrounds of functional properties that various materials exhibit, understand the research trend, and learn various experimental methods by thoroughly reading the newest literature. The knowledge will be deepened by presentation and discussion during the seminar.

Goals:

1. Undersitanding the basic physics producing material functions.
2. Analyzing characteristic properties from various aspects
3. Applying these knowledges to research and development of actual functional materials.

●Prerequisite Subjects

Quantum Mechanics, Thermodynamics, Statistical Physics, Electromagnetism, Optical Properties of Solids, Solid State Physics, Seminars on Magnetic Materials Engineering 2A, 2B, 2C, and 2D.

●Course Topics

1. Electronic Properties of Solids 2. Electronic Correlations 3. Magnetism 4. Transport Properties 5. Optical Properties 6. Thermal Properties 7. Mechanical Properties 8. Solid State Chmesitry

The latest papers on condensed matter physics and materials science will be examined in detail from the above viewpoints, and oral presentations and questions will be made.

●Textbook

A paper will be chosen from the newest literature each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
N. W. Ashcroft and N. D. Mermin, Solid State Physics (W. B. Saunders)
P. A. Cox, The Electronic Structure and Chemistry of Solids (Oxford University Press)
F. Wooten, Optical Properties of Solids (Academic Press)

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

There is no requirement for taking this class, but it is desired to have already finished Seminars on Magnetic Materials Engineering 2A, 2B, 2C, and 2D.

●Contacting Faculty

Questions are welcome within or after each lecture.

Seminar on Computational Engineering Mathematics 2A (2.0credits) (計算数理工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 2B (2.0credits) (計算数理工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 2C (2.0credits) (計算数理工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 2D (2.0credits) (計算数理工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Engineering Mathematics 2E (2.0credits) (計算数理工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Shao_Liang Zhang Professor	Tomohiro SOGABE Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

Through reading recent papers in the field of numerical algorithms, optimization and high performance computing, students are encouraged to advance his/her own research.

●Prerequisite Subjects

Linear algebra I, II, Analysis, Applied mathematics

●Course Topics

1. Fast and accurate algorithms for large-scale numerical linear algebra
2. Practical algorithms for combinatorial optimization problems
3. High performance computing

●Textbook

●Additional Reading

●Grade Assessment

Oral Examination:

●Notes

●Contacting Faculty

Seminar on Computational Condensed Matter Physics 2A (2.0credits) (計算物性工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Thermodynamics, Statistical Mechanics, Biological Science

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

Not specified.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Active discussion based on your own questions is the minimum requirement for seminar.

Seminar on Computational Condensed Matter Physics 2B (2.0credits) (計算物性工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

Not specified.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Active discussion based on your own questions is the minimum requirement for seminar.

Seminar on Computational Condensed Matter Physics 2C (2.0credits) (計算物性工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

Not specified.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Active discussion based on your own questions is the minimum requirement for seminar.

Seminar on Computational Condensed Matter Physics 2D (2.0credits) (計算物性工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

Not specified.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Active discussion based on your own questions is the minimum requirement for seminar.

Seminar on Computational Condensed Matter Physics 2E (2.0credits) (計算物性工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Masaki SASAI Professor	Tomoki TERADA Associate Professor	Joji CHIKENJI Assistant Professor

●Course Purpose

1. Understanding and explaining the structures and functions of proteins
2. Understanding and explaining key methods for studying dynamics and stability of the proteins
3. Understanding and explaining important cellular processes such as gene expression and regulation networks

●Prerequisite Subjects

Biological Science, Biophysics, Thermodynamics, Statistical Physics, Soft Matter Physics

●Course Topics

1. Protein Structures
2. Protein Functions
3. Genomic Information Analysis
4. Structures and Functions of DNA and RNA
5. Structures and Functions of Biomolecular Networks

●Textbook

Not specified.

●Additional Reading

Not specified.

●Grade Assessment

Achievement of the goals are evaluated equally by the presentations and discussions. Record more than 60/100 is qualified.

●Notes

Not specified.

●Contacting Faculty

Active discussion based on your own questions is the minimum requirement for seminar.

Seminar on Crystal Physics 2A (2.0credits) (結晶物性工学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose
Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects
Seminar on Crystal Physics 1, Crytal Physics,Material Physics

●Course Topics
1. Classification of nano crystalline materials
2. Fabrication of nano crystalline materials
3. Characterization of nano crystalline materials
4. Application of nanocrystalline materials

●Textbook
None

●Additional Reading
None

●Grade Assessment
Oral test

●Notes
None

●Contacting Faculty
Questions are accepted during the seminar.

Seminar on Crystal Physics 2B (2.0credits) (結晶物性工学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Seminars on statistical physics of phase transitions and nonlinear and nonequilibrium pnenomena, and the analyses of atomic and electronic structures of micro-clusters with electron microscopy, electron diffraction and electron-energy loss spectroscopy.

●Prerequisite Subjects

Seminar on Crystal Physics 1, Crytal Physics, Material Physics

●Course Topics

1. Phase transitions and critical phenomena
2. Phase transitions of crystals and liquid crystals
3. Atomic structure of micro-clusters
4. Electronic structure of micro-clusters

●Textbook

None

●Additional Reading

None

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted during the lecture.

Seminar on Crystal Physics 2C (2.0credits) (結晶物性工学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects

Seminar on Crystal Physics 1,Crytal Physics,Material Physics

●Course Topics

1. Classification of nano crystalline materials
2. Fabrication of nano crystalline materials
3. Characterization of nano crystalline materials
4. Application of nanocrystalline materials

●Textbook

None

●Additional Reading

None

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted during the seminar

Seminar on Crystal Physics 2D (2.0credits) (結晶物性工学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects

Seminar on Crystal Physics 1,Crytal Physics,Material Physics

●Course Topics

1. Phase transitions and critical phenomena
2. Phase transitions of crystals and liquid crystals
3. Atomic structure of micro-clusters
4. Electronic structure of micro-clusters

●Textbook

None

●Additional Reading

None

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted during the seminar

Seminar on Crystal Physics 2E (2.0credits) (結晶物性工学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Koh SAITOH Professor	Makoto KUWAHARA Associate Professor	Takafumi ISHIDA Assistant Professor

●Course Purpose

Seminars on the fabrication, characterization and application of nanocrystalline materials using original papers as a text.

●Prerequisite Subjects

Seminar on Crystal Physics 1, Crytal Physics, Material Physics

●Course Topics

1. Phase transitions and critical phenomena
2. Phase transitions of crystals and liquid crystals
3. Atomic structure of micro-clusters
4. Electronic structure of micro-clusters

●Textbook

None

●Additional Reading

None

●Grade Assessment

Oral test

●Notes

None

●Contacting Faculty

Questions are accepted during the seminar

Seminar on Nano-Structural Analysis 2A (2.0credits) (ナノ構造解析学セミナー2A)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the seminar.

Seminar on Nano-Structural Analysis 2B (2.0credits) (ナノ構造解析学セミナー2B)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	1 Autumn Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Seminar on Nano-Structural Analysis 2C (2.0credits) (ナノ構造解析学セミナー2C)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Seminar on Nano-Structural Analysis 2D (2.0credits) (ナノ構造解析学セミナー2D)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	2 Autumn Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

Nothing special.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Seminar on Nano-Structural Analysis 2E (2.0credits) (ナノ構造解析学セミナー2E)

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Applied Physics		
Starts 1	3 Spring Semester		
Lecturer	Satoshi KASHIWAYA Professor	Koji ASAKA Lecturer	Hitoshi NAKAHARA Assistant Professor

●Course Purpose

Through reading scientific literature on novel physical properties peculiar to the surface and interface through the observation of the electronic properties, students are trained to understand basic principles of electronic states and devices consists of novel superconductors, topological materials, atomic layer materials, etc.

●Prerequisite Subjects

Solid State Physics, Quantum Mechanics, Electromagnetism, Statistical mechanics

●Course Topics

1. Development and application of superconducting devices using surface / interface
2. Topological superconductivity and topological quantum computation
3. Electric field induced superconductivity and Josephson junctions
4. Novel physics on Majorana quasiparticles and axion dark matters
5. Surface physics of low-dimensional nanostructures on graphene and nanotube
6. Structures and physical properties of nano-materials

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Text books for this seminar will be determined at the beginning of each semester. Scientific papers are chosen in accord with the progress of the seminar.

●Additional Reading

We will introduce references on demand.

●Grade Assessment

Object achievement is evaluated by quality of presentation and answers against questions in the seminar. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

Nothing special.

●Contacting Faculty

Answer during the lecture.

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

●Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant’s research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

●Textbook
Will be introduced at the host laboratory depending on the research subject

●Additional Reading
Will be introduced at the host laboratory if necessary

●Grade Assessment
Conducting research in an abroad laboratory for one semester and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

●Notes
Nothing particularly needed

●Contacting Faculty
Questions will be answered by the supervisors at the host laboratory during the course.

Course Type	Specialized Courses		
Division at course	Doctor's Course		
Class Format	Seminar		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by studying in an abroad laboratory and learn different methods and ways of thinking, as well as communicate on a daily base with foreign researchers.

By completing the course, the students are expected to acquire various research methods and ways of thinking, gain the ability to tackle research problems from multiple angles, and acquire a broad international perspective.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject, English, Advanced Lectures on Scientific English

●Course Topics

Students will stay in an abroad laboratory that will be chosen based on the participant’s research field and interest. The course consists of the following contents.

1. Theme setting and literature review
2. Formulating a research plan
3. Analyzing the results and discussion
4. Presentation of the results

After the class, students should review the analyzing processes of the research results and investigate related literatures.

●Textbook
Will be introduced at the host laboratory depending on the research subject

●Additional Reading
Will be introduced at the host laboratory if necessary

●Grade Assessment
Conducting research in an abroad laboratory for two semesters and submitting a report is a prerequisite. Evaluation will be based on the student's report (50%) and oral presentation (50%). To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results.

●Notes
Nothing particularly needed

●Contacting Faculty
Questions will be answered by the supervisors at the host laboratory during the course.

Teaching and Instruction Exercise 1 (1.0credits) (実験指導体験実習1)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

While attendance is raw, in "the innovation experience project," I stand with a company engineer (DP, Directing Professor) and carry an assistance, DP of the attendance straight instruction by the DP and the role of the interface of the attendance student. In this way, it is intended to let you do experience of the project management.
I aim for planning a researcher, improvement of the nature as the leader, the expansion of the field of vision by a simulated experience of instruction of the attendance life and the business management in the real world.

●Prerequisite Subjects

"Innovation Practice Course" 75 hours(Principle one day a week)

●Course Topics

In "the innovation experience project," I assist the project promotion by the DP.
Help of the understanding of a project theme and contents for the attendance life of various specialisms
I compile an opinion of the attendance life and let you make a purpose, the method of the project clear
Exchange of opinions between the attendance life, instruction, report of the discussion
Communication adjustment that DP and attendance are raw
I assume this a main component.
In addition, correspondence out of the lecture time is necessary when preparations, an investigation to affect project accomplishment are necessary.

●Textbook

documents that a lecturer (DP) introduces it and shows.

●Additional Reading
documents that a lecturer (DP) introduces it and shows.

●Grade Assessment
I evaluate it through accomplishment, the discussion of the project. If display of leadership, report ability and the leadership is accepted, it is said that I pass.

●Notes
There are no prerequisites

●Contacting Faculty
A lecturer (DP) and this project staff of the university accept questions at any time.

Teaching and Instruction Exercise 2 (1.0credits) (実験指導体験実習2)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Syusaku NAGANO Associate Professor		

●Course Purpose

The purpose of this course is to provide guidance to semester students for advanced science and engineering experiments at the Venture Business Laboratory. Through this research guidance, students will be able to play a comprehensive role as a researcher / educator and instructor in the field in charge of Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation, and will be able to provide research guidance. Useful for practical training as a research leader.

●Prerequisite Subjects

Knowledge of the field in charge selected from the fields of Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation.

●Course Topics

In the student experiment, the instructor students provide guidance to attendant students on subject research and original research from the field of Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation with the professional teacher. Together with the attendant students, they perform practical use these equipment and software and get the results. They experience the leadership of the research, providing research guidance, report preparation guidance, and presentation guidance.

●Textbook

Required documents is distributed.

●Additional Reading

Required documents is distributed.

●Grade Assessment

Evaluate by compiling experiments / exercises, teaching (70%), and interviewing (30%). Students who understand each device and software and give appropriate guidance are accepted, and their research results and new approaches are highly evaluated. A score of 60 or more out of 100 is a passing score.

●Notes

To have a deep understanding in one field from Raman spectroscopy, ionization potential measurement, X-ray diffraction measurement, and molecular simulation.

●Contacting Faculty

Arranging the schedules by e-mail and etc.

Research Internship2 U2 (2.0credits) (研究インターンシップ２ U2)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

●Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

●Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

●Textbook

not specified.

●Additional Reading

not specified.

●Grade Assessment

The credits will be given to the students who have had the working days less than or equal to 20 days in the internship company.

●Notes

●Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Research Internship2 U3 (3.0credits) (研究インターンシップ２ U3)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

●Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

●Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

●Textbook

not specified.

●Additional Reading

not specified.

●Grade Assessment

The credits will be given to the students who have had the working days between 21 and 40 days in the internship company.

●Notes

●Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Research Internship2 U4 (4.0credits) (研究インターンシップ２ U4)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

●Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

●Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

●Textbook

not specified.

●Additional Reading

not specified.

●Grade Assessment

The credits will be given to the students who have had the working days between 41 and 60 days in the internship company.

●Notes

●Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Research Internship2 U6 (6.0credits) (研究インターンシップ２ U6)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

●Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

●Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

●Textbook

not specified.

●Additional Reading

not specified.

●Grade Assessment

The credits will be given to the students who have had the working days between 61 and 80 days in the internship company.

●Notes

●Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Research Internship2 U8 (8.0credits) (研究インターンシップ２ U8)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Materials Design Innovation Engineering
	Materials Process Engineering	Chemical Systems Engineering	Electrical Engineering
	Electronics	Information and Communication Engineering	Mechanical Systems Engineering
	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering	Department of Energy Engineering
	Department of Applied Energy	Civil and Environmental Engineering	
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	
Lecturer	Hiroshi IKUTA Professor		

●Course Purpose

Research internship is different from conventional internship for a working experience. Staffs in the faculty and instructors in a company cooperate with each other to set up research themes adequate to the doctoral course, and supervise a long-term internship for 1-6 months. This course aims at training of a person who has ability for an advanced research and development in not only a specialized field but also a multidisciplinary field, and a leader capable of making a proper judgment in a research project.

●Prerequisite Subjects

Students attending Research Internship are strongly recommended to take short-term Patent Laws and Focus on Venture Business I or II before the attendance.

●Course Topics

A student applies for a theme for research set up under the cooperation of a company and Nagoya University. Students should attend at the lecture at the university on the duty of confidentiality and the protection of intellectual property rights before starting the internship.

●Textbook

not specified.

●Additional Reading

not specified.

●Grade Assessment

The credits will be given to the students who have had the working days more than or equal to 81 daysin the internship company.

●Notes

●Contacting Faculty

The questions will be answered by the direct supervisors as needed at the internship.

Laboratory Visit 1 U2 (2.0credits) (研究室ローテーション２ U2)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields.By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject

●Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant’s research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents.1. Theme setting and literature review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter the class, students should review the analyzing process of the obtained results and investigate related literatures.

●Textbook

Will be introduced at the host laboratory depending on the research subject

●Additional Reading

Will be introduced at the host laboratory if necessary

●Grade Assessment

Up to 20 days research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

●Notes

Nothing particularly needed

●Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Laboratory Visit 1 U3 (3.0credits) (研究室ローテーション２ U3)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields.By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject

●Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant’s research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents.1. Theme setting and literature review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter the class, students should review the analyzing process of the obtained results and investigate related literatures.

●Textbook

Will be introduced at the host laboratory depending on the research subject

●Additional Reading

Will be introduced at the host laboratory if necessary

●Grade Assessment

21 days or more and 40 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

●Notes

Nothing particularly needed

●Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Laboratory Visit 1 U4 (4.0credits) (研究室ローテーション２ U4)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields.By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject

●Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant’s research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents.1. Theme setting and literature review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter the class, students should review the analyzing process of the obtained results and investigate related literatures.

●Textbook

Will be introduced at the host laboratory depending on the research subject

●Additional Reading

Will be introduced at the host laboratory if necessary

●Grade Assessment

41 days or more and 60 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

●Notes

Nothing particularly needed

●Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Laboratory Visit 1 U6 (6.0credits) (研究室ローテーション２ U6)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields.By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject

●Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant’s research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents.1. Theme setting and literature review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter the class, students should review the analyzing process of the obtained results and investigate related literatures.

●Textbook

Will be introduced at the host laboratory depending on the research subject

●Additional Reading

Will be introduced at the host laboratory if necessary

●Grade Assessment

61 days or more and 80 days or less research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

●Notes

Nothing particularly needed

●Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.

Laboratory Visit 1 U8 (8.0credits) (研究室ローテーション２ U8)

Course Type	Comprehensive engineering courses		
Division at course	Doctor's Course		
Class Format	Practice		
Course Name	Molecular and Macromolecular Chemistry	Materials Chemistry	Biomolecular Engineering
	Applied Physics	Materials Physics	Chemical Systems Engineering
	Electrical Engineering	Electronics	Information and Communication Engineering
	Mechanical Systems Engineering	Micro-Nano Mechanical Science and Engineering	Aerospace Engineering
Starts 1	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
	1 Spring and Autumn Semester	1 Spring and Autumn Semester	1 Spring and Autumn Semester
Lecturer	Associated Faculty		

●Course Purpose

The aim of this course is to expand the student’s ability as a researcher by conducting a research at a different laboratory and learn different methods and ways of thinking, as well as communicate with other researchers in related fields.By completing the course, the students are expected to acquire various research methods and ways of thinking, and gain the ability to tackle research problems from multiple angles.

●Prerequisite Subjects

Basic and specialized subjects related to the research subject

●Course Topics

Students will conduct research at a different laboratory. The host laboratory will be chosen based on the participant’s research field and interest from other laboratories within the campus, other universities, research institutes and companies. The course consists of the following contents.1. Theme setting and literature review2. Formulating the research plan3. Analyzing the results and discussion4. Presentation of the resultsAfter the class, students should review the analyzing process of the obtained results and investigate related literatures.

●Textbook

Will be introduced at the host laboratory depending on the research subject

●Additional Reading

Will be introduced at the host laboratory if necessary

●Grade Assessment

81 days or more research in the host laboratory and submitting a report is a prerequisite. Evaluation will be based on the student's report and the evaluation by the supervisor in the host laboratory. To pass, the students have to demonstrate that they have the capacity to adequately analyze the results and have acquired the basic knowledge to interpret the results. Grading will be decided from P (pass) or NP (not passed).

●Notes

Nothing particularly needed

●Contacting Faculty

Questions will be answered by the supervisors at the host laboratory during the course.