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| 科目名 Course Title                           | 総合化学特別研究第一[Research in Chemical Sciences and Engineering I]         |                               |     |
| 講義題目 Subtitle                              |   |                               |     |
| 責任教員 Instructor                            | 総合化学院代議員  |                               |     |
| 担当教員 Other Instructors                     | 担当は主任指導教員   |                               |     |
| 科目種別 Course Type                           |   |                               |     |
| 開講年度 Year                                  | 2022  | 時間割番号 Course Number           |     |
| 期間 Semester                                | 通年  | 単位数 Number of Credits         | 4   |
| 授業形態 Type of Class                         | 実験・実習   | 対象年次 Year of Eligible Student | 1～3 |
| 対象学科・クラス Eligible Department/Class         |   |                               |     |
| ナンバリングコード Numbering Code                   | CHEM_REQUI 7001   |                               |     |
| 補足事項 Other Information                     |   |                               |     |
| <b>キーワード Key Words</b>                     | 総合化学、理学、工学、論文作成   |                               |     |
| <b>授業の目標 Course Objectives</b>             | 化学に関する具体的なテーマについて問題解決と論文作成方法を習得するために、指導教員の指導のもとに、個別の課題を選定して研究を推進する。 |                               |     |
| <b>到達目標 Course Goals</b>                   | 選定した個別の課題の研究を通じ、多角的かつ論理的思考による問題解決と論文作成方法を習得する。                      |                               |     |
| <b>授業計画 Course Schedule</b>                | 化学に関する特定の課題を探索し、それについて高度に専門的な研究を行い、その成果を研究論文として公表する。                |                               |     |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>         | 実験、データ整理、発表準備、論文執筆には多くの時間を要する。恒常的な調査研究が要求される。                       |                               |     |
| <b>成績評価の基準と方法 Grading System</b>           | 博士後期課程在籍期間における、中間発表での発表、課題への取り組み状況、作成論文等によって評価する。                   |                               |     |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                               |     |
| <b>テキスト・教科書 Textbooks</b>                  |   |                               |     |
| <b>講義指定図書 Reading List</b>                 |   |                               |     |
| <b>参照ホームページ Websites</b>                   |   |                               |     |
| <b>研究室のホームページ Websites of Laboratory</b>   |   |                               |     |
| <b>備考 Additional Information</b>           | 修了もしくは単位修得退学時に単位認定を行うため、履修登録の必要はない。                                 |                               |     |

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| 科目名 Course Title                           | 総合化学研究・指導法[Research in Chemical Sciences and Engineering III]   |                               |     |
| 講義題目 Subtitle                              |   |                               |     |
| 責任教員 Instructor                            | 総合化学院代議員  |                               |     |
| 担当教員 Other Instructors                     | 担当は主任指導教員   |                               |     |
| 科目種別 Course Type                           |   |                               |     |
| 開講年度 Year                                  | 2022  | 時間割番号 Course Number           |     |
| 期間 Semester                                | 通年  | 単位数 Number of Credits         | 2   |
| 授業形態 Type of Class                         | 演習  | 対象年次 Year of Eligible Student | 1～3 |
| 対象学科・クラス Eligible Department/Class         |   |                               |     |
| ナンバリングコード Numbering Code                   | CHEM_REQEL 7101   |                               |     |
| 補足事項 Other Information                     |   |                               |     |
| <b>キーワード Key Words</b>                     | 実験法の改良・開発 実験指導法 成果とりまとめとプレゼンテーション技法 論文執筆 化学英語   |                               |     |
| <b>授業の目標 Course Objectives</b>             | 博士研究を遂行するにあたって必要となる実験手法・技法の改良や開発、研究成果の取りまとめとプレゼンテーション法、英語による論文執筆の進め方等を系統的に学習し、実験・研究指導者となるための実践的知識と能力を養う。  |                               |     |
| <b>到達目標 Course Goals</b>                   | 博士学位取得者として備えるべき研究開発能力やプレゼンテーション能力、成果取りまとめ能力、分野開拓能力等を実践的に養う。   |                               |     |
| <b>授業計画 Course Schedule</b>                | 博士課程における各学年において、大学院生の研究・学習の進捗状況に応じて適宜、以下の指導を行うことにより、授業の目標を達成する。<br><br>1) 研究テーマに関する研究計画、計画を遂行するための実験手法の改良・開発に関する課題を与え、その取り組み状況に応じて適切なアドバイスを与え、より大きな成果が上がるよう指導する。必要に応じ、適宜、レポート提出を求めるとともに、実験・研究指導を行う。<br>2) 研究結果の取りまとめ、プレゼンテーション法の技術的・科学的指導を行う。特に、論理的に研究成果をまとめ、その成果を客観的かつ明確にプレゼンテーションする技法の指導を行う。<br>3) 英文を含めた論文執筆法の指導を行う。研究成果を論理的に整理し、適切な取りまとめを通して、科学技術論文として発表を行うことのできる能力を養う。日本語・英語ともに、適切な論文取りまとめができる能力を養う指導を行う。<br><br>このような取り組みを通して、博士取得者としての新たな実験法の開発能力や総合的な問題解決能力・指導力を涵養する。 |                               |     |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>         | 与えられた課題に対し、次の実験・研究段階に進むための十分な準備学習。  |                               |     |
| <b>成績評価の基準と方法 Grading System</b>           | 日常的な取り組みと定期的なレポート作成(50%)、取り組みの成果等(50%)を総合的に評価する。  |                               |     |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                               |     |
| <b>テキスト・教科書 Textbooks</b>                  |   |                               |     |
| <b>講義指定図書 Reading List</b>                 |   |                               |     |
| <b>参照ホームページ Websites</b>                   |   |                               |     |
| <b>研究室のホームページ Websites of Laboratory</b>   |   |                               |     |
| <b>備考 Additional Information</b>           |   |                               |     |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論 I [Modern Trends in Chemical Sciences and Engineering I]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | 総合化学特論 I [Modern Trends in Physical and Material Chemistry]  |                                      |        |
| <b>責任教員 Instructor</b>                     | 上野 貢生 [UENO Kosei] (大学院理学研究院)  |                                      |        |
| <b>担当教員 Other Instructors</b>              | 小松崎 民樹[KOMATSUZAKI Tamiki], 松尾 保孝[MATSUO Yasutaka](電子科学研究所), 北川 裕一[KITAGAWA Yuichi](工学研究院), 真栄城 正寿[MAEKI Masatoshi](工学研究院), 今枝 佳祐(理学研究院)   |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095111 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ~      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7111  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | Molecular photochemistry, Plasmonic photochemistry, Solid state ionics, Near-field microspectroscopy, Nanobiotechnology, Nanofabrication, Thin film device, Lipid nanoparticles, AI, Measuremental science   |                                      |        |
| <b>授業の目標 Course Objectives</b>             | <p>This course aims to provide opportunity for students to contact with different majors' professors and to expand students' horizons. In this course, professors explain the basic concept and overview absolutely essential for understanding of advanced research topics, and introduce their recent research works.</p> <p>Topics introduced by professors are: Light energy harvesting with metallic nanostructures, Near-field characteristics of plasmonic nanostructures, Photochemistry and photophysics of lanthanide complexes, Materials chemistry of advanced rechargeable batteries, Next-generation of life science based on nanobiotechnology, Microfluidic-based approaches for lipid nanoparticle synthesis, New application development of atomic layer deposition.</p> |                                      |        |
| <b>到達目標 Course Goals</b>                   | Through a series of lectures, students understand various fields of chemistry and are expected to expand their horizons.   |                                      |        |
| <b>授業計画 Course Schedule</b>                | <p>Lectures will be provided by Professors in the Graduate School of Chemical Sciences and Engineering.</p> <p>Detailed schedule will be informed one month before the start of this course.</p> <p>List of lecture titles in this course</p> <ul style="list-style-type: none"> <li>•Light energy harvesting with metallic nanostructures</li> <li>•Near-field characteristics of plasmonic nanostructures</li> <li>•Photochemistry and photophysics of lanthanide complexes</li> <li>•Materials chemistry of advanced rechargeable batteries</li> <li>•Next-generation of life science based on nanobiotechnology</li> <li>•Microfluidic-based approaches for lipid nanoparticle synthesis</li> <li>•New application development of atomic layer deposition.</li> </ul>                  |                                      |        |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>         | Students will be required to submit reports after the lectures.  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Students are required to attend at least 70% of the lectures. Evaluation as pass/fail will be based on the submitted reports.  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |  |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | <p>This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;</p> <p><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G073">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G073</a></p>  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <p><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/</a></p> <p><a href="https://www.cse.hokudai.ac.jp/en/">https://www.cse.hokudai.ac.jp/en/</a></p>  |                                      |        |
| <b>備考 Additional Information</b>           |  |                                      |        |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論 I [Modern Trends in Chemical Sciences and Engineering I]   |                                      |        |
| <b>講義題目 Subtitle</b>                       | 総合化学特論 II [Modern Trends in Organic Chemistry and Biological Chemistry]   |                                      |        |
| <b>責任教員 Instructor</b>                     | 渡慶次 学 [TOKESHI Manabu] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | 小笠原 泰志[OGASAWARA Yasushi](工学研究院), 真栄城 正寿[MAEKI Masatoshi](工学研究院), 山本 靖典[YAMAMOTO Yasunori], 鎌田 瑠泉[KAMADA Rui](理学研究院), 石垣 佑祐[ISHIGAKI Yusuke](理学研究院), 百合野 大雅[YURINO Taiga](工学研究院), 米田 友貴[YONEDA Tomoki](工学研究院)   |                                      |        |
| <b>科目種別 Course Type</b>                    |   |                                      |        |
| <b>開講年度 Year</b>                           | 2022  | <b>時間割番号 Course Number</b>           | 095112 |
| <b>期間 Semester</b>                         | 通年不定期   | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義  | <b>対象年次 Year of Eligible Student</b> | ~      |
| <b>対象学科・クラス Eligible Department/Class</b>  |   |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7111   |                                      |        |
| <b>補足事項 Other Information</b>              |   |                                      |        |
| <b>キーワード Key Words</b>                     | 構造有機化学, 有機合成化学, 反応有機化学, 有機変換化学, 生物化学, 応用生物化学, マイクロシステム化学  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | 有機化学・生物化学分野の進展は目覚ましいものがあります。本講義では、先端的な有機化学・生物化学分野の研究を理解する上で必要となる基本的概念について学習し、最新のトレンドについて概観した後に、最先端の研究成果について学びます。有機化学・生物化学研究の様々なトピックスについて討議します。最先端の有機化学・生物化学研究に関して、独自のアイデアの提案を含むレポートが書けるようになることが目標です。  |                                      |        |
| <b>到達目標 Course Goals</b>                   | <ol style="list-style-type: none"> <li>1. 先端的な有機化学・生物化学分野の研究を理解する上で必要となる基本的概念について説明できる。</li> <li>2. 先端の有機化学・生物化学のトピックスについて説明できる。</li> <li>3. バックグラウンド異なる受講者の中で議論し、討議することができる。</li> <li>4. 自身のアイデアを盛り込んだ研究提案ができる。</li> </ol>   |                                      |        |
| <b>授業計画 Course Schedule</b>                | <ol style="list-style-type: none"> <li>1. ガイダンスならびにマイクロシステム化学入門: マイクロシステム化学研究の歴史とマイクロシステム化学研究を理解する上で必要な基本的概念を学びます。</li> <li>2. 先端マイクロシステム化学: 最先端のマイクロシステム化学について紹介します。</li> <li>3. 先端生物化学: 自然免疫の最先端のトピックについて紹介します。</li> <li>4. 先端応用生物化学: 微生物を用いた有用天然有機化合物創製の最先端研究を紹介します。</li> <li>5. 先端有機変換化学: キラル有機化合物合成のための遷移金属が触媒するエナンチオ選択的付加反応の基本的概念と実例を学びます。</li> <li>6. 先端構造有機化学: 最先端の構造有機化学について紹介します。</li> <li>7. 先端有機合成化学: 反応点の精密制御に基づいた有機合成法の最先端について紹介します。</li> <li>8. 先端反応有機化学: <math>\pi</math> 共役分子を中心とした物理有機化学とその反応に関する最新の化学について説明します。</li> </ol> |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | 本科目では、毎回課題(レポート)が与えられ、指定された期日までに提出します。  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | 学修態度(20%)とレポート(80%)によって評価します。レポートは、各回毎に講師の指示に従って提出します。授業回数の 7 割以上の出席が評価するための最低条件です。   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |   |                                      |        |
| <b>講義指定図書 Reading List</b>                 |   |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G060">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G060</a>  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |   |                                      |        |
| <b>備考 Additional Information</b>           |   |                                      |        |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Molecular Chemistry and Engineering IB - 2022   |                                      |        |
| <b>責任教員 Instructor</b>                     | 伊藤 肇 [ITO Hajime] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | Duncan BROWNE (Cardiff U.), B. RODRIGUEZ-MOLINA (UNAM), Alexander SPOKOYNY (UCLA), 久保田 浩司[KUBOTA Koji](工学研究院)  |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095122 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | organic chemistry, organic synthesis, crystal engineering, organoboron, mechanochemical synthesis  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | Organic chemistry is a field of study that is important for the effective use of resources and for supporting people's comfortable and healthy lives. In this lecture, leading researchers from abroad and Hokkaido University will give intensive lectures on organic chemistry fields that have been developed remarkably recently and will be useful for students to have knowledge in the future. The courses will cover reactions of organic compounds containing boron, structures and reactions of organic crystals, and mechano-organic synthesis. |                                      |        |
| <b>到達目標 Course Goals</b>                   | After the completion of this course, you will be able to know<br>1. advanced chemistry of compounds containing boron and other main-group elements and their synthetic application<br>2. concepts and recent progress in mechanochemical organic synthesis<br>3. design of functional molecular crystals<br>4. how to plan research based on previous research results and literature surveys.   |                                      |        |
| <b>授業計画 Course Schedule</b>                | Course Schedule (the order of the following lectures is subject to change)<br>1. Advanced chemistry of compounds containing boron and other main-group elements I<br>2. Advanced chemistry of compounds containing boron and other main-group elements II<br>3. Mechanochemical organic synthesis I<br>4. Mechanochemical organic synthesis II<br>5. Design of functional molecular crystals I<br>6. Design of functional molecular crystals II<br>7. Research proposal I<br>8. Research proposal II   |                                      |        |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>         | Students will make proposal presentations and reports.   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Grades are judged based on attendance records, presentations, and reports during the course.   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |  |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G069">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G069</a>   |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |  |                                      |        |
| <b>備考 Additional Information</b>           | Other instructors: Alexander M. Spokoyny (UCLA), Braulio Rodriguez-Molina (Instituto de Quimica), Duncan L. Browne (Cardiff University)  |                                      |        |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Molecular Chemistry and Engineering IC - 2022   |                                      |        |
| <b>責任教員 Instructor</b>                     | 長谷川 淳也 [HASEGAWA Junya] (触媒科学研究所)  |                                      |        |
| <b>担当教員 Other Instructors</b>              | Emiel HENSEN (Eindhoven University of Technology), Liang ZHAO (Henan Academy of Sciences), Nino ZAVRADASHVILI (Agricultural University of Georgia), 中野 環 [NAKANO Tamaki] (触媒科学研究所), 中島 清隆 [NAKAJIMA Kiyotaka] (触媒科学研究所), 宋 志毅 [SON Tsui] (触媒科学研究所), SHROTRI ABHIJIT [SHROTRI ABHIJIT] (触媒科学研究所)  |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095123 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | catalysis, polymers with well-defined stereostructure, organotitanium compounds, water purification, CO2 valorization, biomass conversion  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | <p>Carbon neutrality, waste reduction and energy production are the three major issues that must be overcome to create a green society in which energy and chemicals are produced by sustainable means. "Catalysis" has made crucial contribution towards development of our modern society, and it will again play a central role in creating a sustainable future by controlling and influencing chemical reactions.</p> <p>Institute for Catalysis (ICAT) will organize the lectures providing an opportunity to learn "advanced catalytic technologies to building a sustainable society" in an omnibus format. The topic of this course includes 1) synthesis, characterization, and application of advanced polymers, 2) heterogeneous catalysis for the conversion of carbon dioxide to platform molecules, and 3) catalytic valorization of renewable biomass resources for essential chemicals.</p> |                                      |        |
| <b>到達目標 Course Goals</b>                   | <p>By the end of this course you will be able to explain</p> <ol style="list-style-type: none"> <li>1. advanced technologies for the synthesis of functional polymers</li> <li>2. recent technology for water purification using polymer adsorbents</li> <li>3. the design of metal oxide catalysts for selective CO2 conversion</li> <li>4. recent development in catalytic biomass conversion</li> </ol>   |                                      |        |
| <b>授業計画 Course Schedule</b>                | <p>Course Schedule</p> <ol style="list-style-type: none"> <li>1. Synthesis and applications of polymers with defined stereostructure</li> <li>2. Applications of titanium compounds in organic synthesis</li> <li>3. Polymer materials for purification of organic pollutants in water(I)</li> <li>4. Polymer materials for purification of organic pollutants in water(II)</li> <li>5. Principal for design and characterization of heterogeneous catalysts</li> <li>6. Application of heterogeneous catalysts for carbon dioxide hydrogenation</li> <li>7. Smart biomass conversion using heterogeneous catalysts: principal and latest examples</li> <li>8. Lignin valorization using heterogeneous catalysts</li> </ol> <p>Since the course schedule may be changed, please confirm final schedule.</p>  |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | Students will be asked to write a report at the end of each lecture.   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Grades are judged based on active attendance records and reports at the end of each lectures.  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |  |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | <p>This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:</p> <p><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G070">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G070</a></p>  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |  |                                      |        |

**備考 Additional Information**

Other Instructor: Emiel HENSEN (Eindhoven University of Technology), Liang ZHAO (Henan Academy of Sciences), Nino ZAVRADASHVILI (Agricultural University of Georgia)

|  |   |                                      |        |
|--|---|--------------------------------------|--------|
| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]   |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Molecular Chemistry and Engineering II - 2022  |                                      |        |
| <b>責任教員 Instructor</b>                     | 村越 敬 [MURAKOSHI Kei] (大学院理学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | Eric Wei-Guang DIAU (National Chiao Tung University)  |                                      |        |
| <b>科目種別 Course Type</b>                    |   |                                      |        |
| <b>開講年度 Year</b>                           | 2022  | <b>時間割番号 Course Number</b>           | 095124 |
| <b>期間 Semester</b>                         | 通年不定期   | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義  | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |   |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121   |                                      |        |
| <b>補足事項 Other Information</b>              |   |                                      |        |
| <b>キーワード Key Words</b>                     | Physical Chemistry, Spectroscopy, Photochemistry, Femtochemistry  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | This course aims to assist the students to understand the fundamental concepts for the photochemistry and photophysics-related phenomena including electronic structures and transitions, potential energy surfaces, radiative and non-radiationless transitions, energy and electron transfers as well as some photovoltaic and photocatalysis applications related to photochemistry. |                                      |        |
| <b>到達目標 Course Goals</b>                   | To provide the scientific background for the students to understand the basic principles on photochemistry at the molecular level and further apply these principles on applications of solar cells and photocatalysis.   |                                      |        |
| <b>授業計画 Course Schedule</b>                | <ol style="list-style-type: none"> <li>1. Electronic configuration and term symbol of molecules</li> <li>2. Transitions between states</li> <li>3. Radiative and nonradiative transitions</li> <li>4. Experimental techniques</li> <li>5. Applications on photovoltaics and photocatalysis</li> </ol>   |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | The basic parts of a Physical Chemistry textbook covering the sections of Quantum Chemistry, Spectroscopy and Kinetics and Dynamics.  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | One final written exam will be given to students for the grading.   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  | Principles of Molecular Photochemistry, An Introduction / N. J. Turro, V. Ramamurthy and J. C. Scaiano: University Science, 2009<br>Molecular Fluorescence - Principles and Applications / B. Valeur: Wiley-VCH, 2002<br>Principles of Fluorescence Spectroscopy, 2nd, Ed / J. R. Lakowicz: Kluwer Academic / Plenum Publishers, 1999   |                                      |        |
| <b>講義指定図書 Reading List</b>                 |   |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G072">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G072</a>                                  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <a href="http://diau08.ac.nctu.edu.tw/">http://diau08.ac.nctu.edu.tw/</a>   |                                      |        |
| <b>備考 Additional Information</b>           | Other Instructor: Eric Wei-Guang DIAU (National Chiao Tung University)  |                                      |        |



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| 科目名 Course Title   | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II] |                               |        |
| 講義題目 Subtitle  | Separation Process Engineering I                                    |                               |        |
| 責任教員 Instructor  | 向井 紳 [MUKAI Shin] (大学院工学研究院)  |                               |        |
| 担当教員 Other Instructors   |   |                               |        |
| 科目種別 Course Type   |   |                               |        |
| 開講年度 Year  | 2022  | 時間割番号 Course Number           | 095125 |
| 期間 Semester  | 通年不定期   | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class   | 講義  | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class   |   |                               |        |
| ナンバリングコード Numbering Code   | CHEM_REQEL 7121   |                               |        |
| 補足事項 Other Information   |   |                               |        |
| <b>キーワード Key Words</b>   |   |                               |        |
| 多孔質材料, 吸着  |   |                               |        |
| <b>授業の目標 Course Objectives</b>   |   |                               |        |
| 分離プロセスの中でも特に多孔質材料を利用して分離するプロセスの原理を学ぶことを目標とする。  |   |                               |        |
| <b>到達目標 Course Goals</b>   |   |                               |        |
| <ol style="list-style-type: none"> <li>1. 吸着が起こる原理を理解すること</li> <li>2. 吸着等温線の測定法を理解しその形状から材料の特性を定性的に説明できるようになること</li> <li>3. 一般的に利用されている吸着式と吸着理論を理解し, これらを用いて吸着等温線の解析ができるようになること。</li> </ol>  |   |                               |        |
| <b>授業計画 Course Schedule</b>  |   |                               |        |
| 本講義は対面式で札幌キャンパスで実施します。   |   |                               |        |
| <ol style="list-style-type: none"> <li>1. 概論</li> <li>2. 吸着現象</li> <li>3. 代表的な吸着剤とその製造法</li> <li>4. 吸着のメカニズム</li> <li>5. 吸着等温線</li> <li>6. 吸着式と吸着理論 (Henry 式、Freundlich 式、Langmuir 式)</li> <li>7. 吸着式と吸着理論 (BET 吸着等温式)</li> <li>8. 試験</li> </ol>   |   |                               |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>  |   |                               |        |
| 授業の前に配布資料(参考資料, 論文) の該当箇所を読み, 授業終了後は学習した項目について復習し, クイズの内容を確認することにより理解を深める。   |   |                               |        |
| <b>成績評価の基準と方法 Grading System</b>   |   |                               |        |
| 原則として, 授業回数の 7 割以上の出席を成績評価の条件とする。(1)学修態度(20%), (2)クイズ(20%), (3)期末テスト(60%)によって評価する。クイズでは授業のテーマについての理解の深まりを, 試験では本科目の習得度を評価する。   |   |                               |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>   |   |                               |        |
| <b>テキスト・教科書 Textbooks</b>  |   |                               |        |
| <b>講義指定図書 Reading List</b>   |   |                               |        |
| <b>参照ホームページ Websites</b>   |   |                               |        |
| This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G074">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G074</a> |   |                               |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |   |                               |        |
| <b>備考 Additional Information</b>   |   |                               |        |
| 本講義の理解には, 学部レベルの数学, 輸送現象論, 熱力学・統計熱力学, 分離プロセス(蒸留, 乾燥, 吸着)に関する知識を必須とする。  |   |                               |        |

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| <b>科目名 Course Title</b>                   | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                      | Separation Process Engineering II  |                                      |        |
| <b>責任教員 Instructor</b>                    | 荻野 勲 [OGINO Isao] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>             |  |                                      |        |
| <b>科目種別 Course Type</b>                   |  |                                      |        |
| <b>開講年度 Year</b>                          | 2022   | <b>時間割番号 Course Number</b>           | 095126 |
| <b>期間 Semester</b>                        | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                 | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b> |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>           | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>             |  |                                      |        |
| <b>キーワード Key Words</b>                    | 多孔質材料, 吸着, 膜分離, クロマトグラフィー  |                                      |        |
| <b>授業の目標 Course Objectives</b>            | 分離プロセスの中でも特に多孔質材料を利用して分離するプロセス(吸着や膜分離プロセスなど)について、その原理を学び、演習を通して理解を深めることを目標とする。   |                                      |        |
| <b>到達目標 Course Goals</b>                  | <ol style="list-style-type: none"> <li>1. 工業プロセスにおける分離操作の役割を理解すること</li> <li>2. 速度と平衡の観点から分離プロセスの分類について理解すること</li> <li>3. 分離プロセス設計に関わる熱力学(統計熱力学を含む)と輸送現象論について理解を深めること</li> <li>4. 吸着と膜分離プロセスに関わる概念を理解し、基本的な設計が行えるようになること</li> <li>5. 吸着と膜分離の機能を有するデバイスや製品開発に関わる基本的な設計が行えるようになること</li> </ol>   |                                      |        |
| <b>授業計画 Course Schedule</b>               | <ol style="list-style-type: none"> <li>1. 工業分離プロセスの役割(I 第1章とII 第1, 2章)</li> <li>2. 分離プロセス設計に関わる熱力学と輸送現象論(I 第2, 3章)</li> <li>3. 吸着プロセス(I 第15章)</li> <li>4. ケーススタディー1(吸着式除湿器, 浄水器)(II 第5章)</li> <li>5. ケーススタディー2(排水処理)(I 第15章とII 第5章)</li> <li>6. 膜分離プロセス(I 第14章)</li> <li>7. ケーススタディー3(逆浸透膜を用いた水処理装置)(II 第5章)</li> <li>8. プロジェクト(*)</li> </ol> <p>* 海外から研究者を招へいし、膜分離プロセス開発に関する講演会を開催する予定<br/>(注)I: 教科書1, II: 教科書2</p>                       |                                      |        |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>        | 授業の前にテキスト, 配布資料(参考資料, 論文) の該当箇所を読み課題に取り組む。また, 授業で学習した項目について宿題(テキスト章末問題等)を解くことにより理解を深める。  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>          | 原則として, 授業回数の 7 割以上の出席を成績評価の条件とする。(1)学修態度(20%), (2)授業中のクイズと宿題(30%), (3)プロジェクトの結果(50%)によって評価する。クイズと宿題では授業のテーマについての理解の深まりを、そしてプロジェクトでは応用力を評価する。   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                 | <ol style="list-style-type: none"> <li>1. Separation Process Principles: With Applications Using Process Simulators, 4th Edition/J. D. Seader, Ernest J. Henley, D. Keith Roper: John Wiley &amp; Sons, Inc., 2016</li> <li>2. Product and Process Design Principles: Synthesis, Analysis and Evaluation, 4th Edition/Warren D. Seider, Daniel R. Lewin, J. D. Seader, Soemantri Widagdo, Rafiqul Gani, Ka Ming Ng: Wiley, 2016</li> </ol> |                                      |        |
| <b>講義指定図書 Reading List</b>                | 現代化学工学/橋本健治、荻野文丸 編:産業図書, 2001  |                                      |        |
| <b>参照ホームページ Websites</b>                  | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G075">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G075</a>   |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>  |  |                                      |        |
| <b>備考 Additional Information</b>          | 本講義の理解には, 学部レベルの数学, 輸送現象論, 熱力学・統計熱力学, 分離プロセス(蒸留, 乾燥, 吸着)に関する知識を必須とする。<br>微分方程式の数値解法に関する知識を有することが望ましい。  |                                      |        |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Materials Chemistry and Engineering IA - 2022   |                                      |        |
| <b>責任教員 Instructor</b>                     | 忠永 清治 [TADANAGA Kiyoharu] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | John MAURO (The Pennsylvania State University), NATALY CAROLINA ROSERO NAVARRO, 西井 準治[NISHII Junji](電子科学研究所), 小野 円佳[ONO Madoka](電子科学研究所)   |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095127 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | International Year of Glass 2022, Glass Formation, Glass Structure, Glass Transition, Glass fiber, Proton Conducting Glasses, Solid Electrolyte  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | <p>Science and Applications of Glasses –International Year of Glass 2022–</p> <p>This lecture aims to deepen the understanding of the science and application of glasses in the celebration of the United Nations' International Year of Glass 2022.</p> <p>The lecture will cover basic knowledge of the fundamental features, structure, transition behavior, physical properties and research methods of glasses, and the latest applications of glasses in the research fields of each lecturer.</p> <p>This course will be provided as part of the Hokkaido Summer Institute.<br/>Professor John MAURO of Pennsylvania State University will also be in charge of this lecture.</p>                     |                                      |        |
| <b>到達目標 Course Goals</b>                   | <p>By understanding the fundamentals of glass science and learning about its specific applications, students will gain a deeper understanding of the role that glass materials play in modern life and will be able to introduce new perspectives to their research activities.</p> <p>By being involved in the International Year of Glass as a global event through this lecture, students are expected to acquire a global perspective on their research activities.</p>  |                                      |        |
| <b>授業計画 Course Schedule</b>                | <p>Guidance of Lectures and Introduction of International Year of Glass</p> <p>Fundamentals of Glass Science<br/> lecture 1 Introduction of Glass and Fundamentals of the Glassy State<br/> lecture 2 Structural and Topological Theories of Glass Formation<br/> lecture 3 Composition–Property Relationships, introductory (multiple properties)<br/> lecture 4 Application of structural theories of Glass to glass properties (what can be modeled and what cannot be?)</p> <p>Applications of Glass Materials<br/> 1 Glass fiber and its relationship to structural ordering<br/> 2 Proton conducting glass for future fuel cell<br/> 3 Sulfide–based glasses for all solid state lithium batteries</p> |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | Review the distributed documents and contents in the lectures, and ask any questions at the next class.  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Your attitude in classes (20%) and reports (80%) will affect your final grade.   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  | No textbook required. Handouts will be distributed.  |                                      |        |
| <b>講義指定図書 Reading List</b>                 | Fundamentals of Inorganic Glasses 3rd Edition／Arun Varshneya, John Mauro:Elsevier, 2019<br>Materials Kinetics: Transport and Rate Phenomena／John C. Mauro:Elsevier, 2020   |                                      |        |

**参照ホームページ Websites**

This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;

<https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G062>

**研究室のホームページ Websites of Laboratory**

<https://iyog2022.org/>

<https://iyog2022.jp/>

<https://www.matse.psu.edu/directory/john-mauro>

<http://nanostructure.es.hokudai.ac.jp/eng/index.html>

<https://www.eng.hokudai.ac.jp/labo/inorgsyn/cover-e.htm>

**備考 Additional Information**

This course will be provided as part of the Hokkaido Summer Institute.

Professor John MAURO of Pennsylvania State University will also be in charge of this lecture.

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|--|---|--------------------------------------|--------|
| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]   |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Materials Chemistry and Engineering IB - 2022  |                                      |        |
| <b>責任教員 Instructor</b>                     | 島田 敏宏 [SHIMADA Toshihiro] (大学院工学研究院)  |                                      |        |
| <b>担当教員 Other Instructors</b>              | Wenhao SUN (University of Michigan), 三浦 章 [MIURA Akira] (工学研究院)   |                                      |        |
| <b>科目種別 Course Type</b>                    |   |                                      |        |
| <b>開講年度 Year</b>                           | 2022  | <b>時間割番号 Course Number</b>           | 095128 |
| <b>期間 Semester</b>                         | 通年不定期   | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義  | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |   |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121   |                                      |        |
| <b>補足事項 Other Information</b>              |   |                                      |        |
| <b>キーワード Key Words</b>                     | materials informatics, python   |                                      |        |
| <b>授業の目標 Course Objectives</b>             | The course provides lectures combined with exercises. In the lecture, basic knowledge of statistical methods and machine learning for materials research. In the exercises, we start from basic python programming and instruct how to use various libraries and databases. Participants will understand and experience the flow from data to new useful findings. After the training, state-of-the-art results will be given by a professor outside (Prof. Wenhao Sun, Univ. Michigan, USA) in the course. |                                      |        |
| <b>到達目標 Course Goals</b>                   | <ol style="list-style-type: none"> <li>1. Understanding the basics of data science and machine learning, especially about terminology.</li> <li>2. Learning how to use libraries and databases for python.</li> <li>3. Practical usage of packages for materials informatics.</li> </ol>  |                                      |        |
| <b>授業計画 Course Schedule</b>                | <ol style="list-style-type: none"> <li>1. What can we expect from data-science approach in chemistry and materials science.</li> <li>2. Exercises of python programming.</li> <li>3. Basics of informatics and machine learning approach.</li> <li>4. Exercises using chemical and materials informatics packages.</li> </ol>   |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | <p>Requirement: personal computer equipped with a keyboard and internet connection</p> <p>Homework: After each day, homework will be assigned. Students are graded based on the submitted homeworks and the final report.</p>   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Students are requested to submit their programs and results prepared during the course.   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  | None  |                                      |        |
| <b>講義指定図書 Reading List</b>                 | Any textbooks or websites on python language, pandas, and pymatgen  |                                      |        |
| <b>参照ホームページ Websites</b>                   | <p>This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;</p> <p><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G063">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G063</a></p>   |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <p><a href="https://www.eng.hokudai.ac.jp/labo/kotai/en/index.html">https://www.eng.hokudai.ac.jp/labo/kotai/en/index.html</a></p> <p><a href="https://www.eng.hokudai.ac.jp/labo/inorgsyn/cover-e.htm">https://www.eng.hokudai.ac.jp/labo/inorgsyn/cover-e.htm</a></p>   |                                      |        |
| <b>備考 Additional Information</b>           | <p>Required Equipment for a class (Laptop, etc.)</p> <p>A computer with python installed. Instruction of installation will be given to registered students prior to the course.</p>   |                                      |        |

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|--|---|--------------------------------------|--------|
| <b>科目名 Course Title</b>                    | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]   |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Materials Chemistry and Engineering II - 2022  |                                      |        |
| <b>責任教員 Instructor</b>                     | 村越 敬 [MURAKOSHI Kei] (大学院理学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | Bin KANG (Nanjing University)   |                                      |        |
| <b>科目種別 Course Type</b>                    |   |                                      |        |
| <b>開講年度 Year</b>                           | 2022  | <b>時間割番号 Course Number</b>           | 095129 |
| <b>期間 Semester</b>                         | 通年不定期   | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義  | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |   |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121   |                                      |        |
| <b>補足事項 Other Information</b>              |   |                                      |        |
| <b>キーワード Key Words</b>                     | Surface plasmon, Single-particle spectroscopy, Transient imaging, Nanolaser probe, Nanoscale ion transfer, Cellular heat transfer   |                                      |        |
| <b>授業の目標 Course Objectives</b>             | This course is designed to acquire basic knowledge and recent advance in the field of plasmonic spectroscopy and imaging, including the principle of three types of plasmon resonance, single-particles spectroscopy, nanocavity on single particles, and application on measurement of ion migration and heat transfer at nanoscale.   |                                      |        |
| <b>到達目標 Course Goals</b>                   | You will be able to;<br>1. discuss about the basic knowledge about plasmonic photonics<br>2. give a presentation about the state-of-art spectroscopic and imaging techniques using plasmon<br>3. give the solutions about the selected nanoscale and single-cell measurements for life science by attending the course.   |                                      |        |
| <b>授業計画 Course Schedule</b>                | (1) Basics of surface plasmon and plasmonic photonics<br>(2) Single particle spectroscopy for biological analysis<br>(3) Single-particle nanocavity and nanolaser as biological probes (SPASER)<br>(4) Standing-wave plasmon and imaging of chemical hotspots<br>(5) Energy transfer on single nanoparticle and measurement of nanoscale heat transfer<br>This course provides overviews of recent research on some topics from (1) to (5). |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | To read text books for basic principle of surface plasmon or some chapter of solid physics at undergraduate level is highly recommended.  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Assignment on a specified subject regarding to "Recent advance of plasmonic based spectroscopy and imaging" (60%).<br>In addition, we also consider it as the important factor for assessment how actively students participate in each class (40%).  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |   |                                      |        |
| <b>講義指定図書 Reading List</b>                 |   |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G071">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G071</a>  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <a href="https://chem.nju.edu.cn/_s365/kb_en/list.psp">https://chem.nju.edu.cn/_s365/kb_en/list.psp</a>   |                                      |        |
| <b>備考 Additional Information</b>           | Other Instructor: Bin Knag (Nanjing University)<br>Required Equipment for a class (Laptop, etc.): Laptop  |                                      |        |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Materials Chemistry and Engineering IIIA - 2022   |                                      |        |
| <b>責任教員 Instructor</b>                     | 村越 敬 [MURAKOSHI Kei] (大学院理学研究院)  |                                      |        |
| <b>担当教員 Other Instructors</b>              | 野口 秀典[NOGUCHI Hidenori](物質・材料研究機構), 岡本 章玄[OKAMOTO Akihiro](物質・材料研究機構)  |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095130 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | Electrochemistry, Electrocatalysis, In situ surface probe, microbial extracellular electron transport (EET)  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | This course is designed to acquire basic knowledge in electrochemistry, such as electron transfer, electrocatalysis, microbial extracellular electron transport (EET), and in situ surface probe techniques for the research in energy conversion.   |                                      |        |
| <b>到達目標 Course Goals</b>                   | Students will gain not only knowledge of electrochemistry, which form the basis of surface electron transfer which is important in energy conversion materials. Also acquire problem-solving ability for exploring functionality of materials.   |                                      |        |
| <b>授業計画 Course Schedule</b>                | <p>(1) Basics of electrochemistry</p> <p>(2) Electro transfer reaction, Electrocatalysis</p> <p>(3) In situ surface characterization methods</p> <p>(4) Microbial electrochemistry for membrane protein analysis</p> <p>(5) Application of electrochemistry for pathogen sensor and biofilm disinfection</p> <p>This course provides overviews of recent research on some topics from (1) to (5).</p>  |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | To read text books for electrochemistry at undergraduate level is highly recommended.  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | <p>Assignment on a specified subject regarding to "Recent energy conversion systems at solid/liquid interface" (60%).</p> <p>In addition, we also consider it as the important factor for assessment how actively students participate in each class (40%).</p>  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  | No textbook required. Handouts will be distributed.  |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | <p>This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;</p> <p><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G064">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G064</a></p>  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <p><a href="https://www.cse.hokudai.ac.jp/lab/1010/">https://www.cse.hokudai.ac.jp/lab/1010/</a></p> <p><a href="https://www.nims.go.jp/students/en/research/category02.html?csrc=256831576339222729#noguchi01">https://www.nims.go.jp/students/en/research/category02.html?csrc=256831576339222729#noguchi01</a></p> <p><a href="https://www.nims.go.jp/students/en/research/category06.html?csrc=256831576339222729#okamoto01">https://www.nims.go.jp/students/en/research/category06.html?csrc=256831576339222729#okamoto01</a></p> |                                      |        |
| <b>備考 Additional Information</b>           |  |                                      |        |

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| 科目名 Course Title   | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II] |                               |        |
| 講義題目 Subtitle  | Instrumentation Chemistry [Instrumentation Chemistry]             |                               |        |
| 責任教員 Instructor  | 長谷川 靖哉 [HASEGAWA Yasuchika] (大学院工学研究院)                            |                               |        |
| 担当教員 Other Instructors   |   |                               |        |
| 科目種別 Course Type   |   |                               |        |
| 開講年度 Year  | 2022  | 時間割番号 Course Number           | 095131 |
| 期間 Semester  | 通年不定期   | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class   | 講義  | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class   |   |                               |        |
| ナンバリングコード Numbering Code   | CHEM_REQEL 7121   |                               |        |
| 補足事項 Other Information   |   |                               |        |
| <b>キーワード Key Words</b>   |   |                               |        |
| Chemical Information, elemental analysis, conditional analysis, structural analysis in nano- and micro-area.   |   |                               |        |
| <b>授業の目標 Course Objectives</b>   |   |                               |        |
| Grounding in physical, organic and inorganic chemistry.<br>In this course, instrumentation chemistry containing elemental analysis, configurational analysis, structural analysis in nano- and micro-area are introduced. Based on their studies, students learn fundamental knowledges and various information about chemical analysis of organic and inorganic materials.  |   |                               |        |
| <b>到達目標 Course Goals</b>   |   |                               |        |
| Students learn principle, variety and characterization of instrumentation chemistry for material analysis. Based on instrumentation chemistry containing elemental analysis, configurational analysis, structural analysis in nano- and micro-area, students make the most of their knowledges for construction of their chemical research.  |   |                               |        |
| <b>授業計画 Course Schedule</b>  |   |                               |        |
| 1-2. introduction of instrumentation chemistry: importance for structural analysis on the material surface, classification of chemical instruments, grounding in high vacuum engineering<br>3. configurational analysis (TEM, SEM, AFM, STM)<br>4. elemental analysis (AES, EPMA, XPS, XRF)<br>5. structural analysis (XRD, EXAFS, HEED, LEED, SAXS)<br>6. photo-physical analysis (UV-Vis absorption spectra, fluorescence and phosphorescence spectra, emission lifetime, Raman spectra)<br>7. MS spectral analysis (EI-MS, CI-MS, ESI-MS, MALDI-MS, SIMS)<br>8. examination |   |                               |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>  |   |                               |        |
| Pre-examination for review of instrumentation chemistry  |   |                               |        |
| <b>成績評価の基準と方法 Grading System</b>   |   |                               |        |
| The attendance rate must be over 70% to be qualified to take the final exam. Evaluations will be made based on (1) learning attitude (20%), (2) exercise (10%), (3) final examination scores (70%).  |   |                               |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>   |   |                               |        |
| <b>テキスト・教科書 Textbooks</b>  |   |                               |        |
| <b>講義指定図書 Reading List</b>   |   |                               |        |
| <b>参照ホームページ Websites</b>   |   |                               |        |
| This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G065">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G065</a>   |   |                               |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |   |                               |        |
| <a href="https://www.eng.hokudai.ac.jp/labo/amc/index.html">https://www.eng.hokudai.ac.jp/labo/amc/index.html</a>  |   |                               |        |
| <b>備考 Additional Information</b>   |   |                               |        |



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|---|--|--------------------------------------|--------|
| <b>科目名 Course Title</b>   | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]                    |                                      |        |
| <b>講義題目 Subtitle</b>  | Funcitonal Solid State Materials Chemistry[Funcitonal Solid State Materials Chemistry] |                                      |        |
| <b>責任教員 Instructor</b>  | 島田 敏宏 [SHIMADA Toshihiro] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>   |  |                                      |        |
| <b>科目種別 Course Type</b>   |  |                                      |        |
| <b>開講年度 Year</b>  | 2022   | <b>時間割番号 Course Number</b>           | 095132 |
| <b>期間 Semester</b>  | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>   | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>   |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>   | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>   |  |                                      |        |
| <b>キーワード Key Words</b>  |  |                                      |        |
| electronic materials and devices, thermoelectrics, solar cells, hard materials, solid state physics   |  |                                      |        |
| <b>授業の目標 Course Objectives</b>  |  |                                      |        |
| The first goal is to understand the "heart" of chemistry and physics of solid state functional materials and obtain the ability to design and crate new materials. The second goal is to understand what is written in literature with theoretical description. The lecture and the homeworks will be organized to achieve this goal. |  |                                      |        |
| <b>到達目標 Course Goals</b>  |  |                                      |        |
| By the end of this course you will be able to   |  |                                      |        |
| 1. Explain how the devices explained in the lecture works.  |  |                                      |        |
| 2. Obtain basic knowledge of solid state materials.   |  |                                      |        |
| 3. Read advanced literature about the related topics.   |  |                                      |        |
| <b>授業計画 Course Schedule</b>   |  |                                      |        |
| Topics other than the following list can also be lectured according to request.   |  |                                      |        |
| 1. Introduction to solid state chemistry / physics and thermoelectricity  |  |                                      |        |
| 2. Semiconductors focused on solar cells  |  |                                      |        |
| 3. Transparent conductors (oxides, nanowires, graphene)   |  |                                      |        |
| 4. Advanced ligand field theory and basics of photophysics – lasers, nonlinear optics, optical fibers   |  |                                      |        |
| 5. Interfaces: work function and chemistry of semiconductor junction devices  |  |                                      |        |
| 6. Phase memory materials (DVD-R/W, shape memory alloys)  |  |                                      |        |
| 7. Ferroelectrics and shape memory alloy  |  |                                      |        |
| 8. Thermography and strongly correlated electron systems  |  |                                      |        |
| Related theoretical concepts will be introduced every time.   |  |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>   |  |                                      |        |
| Preparation: read the handout posted on the website (URL will be given at the first lecture).   |  |                                      |        |
| Homework: solve the problem given in the lecture and write a brief final report.  |  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>  |  |                                      |        |
| Grading is based on the quiz given at each lecture and the final report.  |  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>  |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>   |  |                                      |        |
| Handout will be given prior to the lecture via website  |  |                                      |        |
| <b>講義指定図書 Reading List</b>  |  |                                      |        |
| <b>参照ホームページ Websites</b>  |  |                                      |        |
| This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;   |  |                                      |        |
| <a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G067">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G067</a>   |  |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>  |  |                                      |        |
| <a href="https://www.eng.hokudai.ac.jp/labo/kotai/en/index.html">https://www.eng.hokudai.ac.jp/labo/kotai/en/index.html</a>   |  |                                      |        |
| <b>備考 Additional Information</b>  |  |                                      |        |

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| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Corrosion Engineering [Corrosion Engineering]  |                                      |        |
| <b>責任教員 Instructor</b>                     | 安住 和久 [AZUMI Kazuhisa] (大学院工学研究院)  |                                      |        |
| <b>担当教員 Other Instructors</b>              |  |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095133 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | Metallic Materials; Complex Materials; Functional Materials; Corrosion Protection.   |                                      |        |
| <b>授業の目標 Course Objectives</b>             | Degradation of materials used in many structures and functional devices is a very important issue to sustain and develop our modern society. Understanding the degradation mechanism, predicting the lifetime of materials, and suppressing the corrosion is, therefore, one of the major subjects of engineering. In the lecture, a theory of corrosion phenomena, examples of typical corrosion and degradation, strategies of corrosion protection, development of degradation resistive materials, and evaluation methods of corrosion rate and lifetime will be introduced.   |                                      |        |
| <b>到達目標 Course Goals</b>                   | <ul style="list-style-type: none"> <li>• Understanding the practical corrosion phenomena based on physical chemistry</li> <li>• Learning how to treat the corrosion-related phenomena quantitatively.</li> <li>• Understanding the engineering techniques applicable to various practical problems.</li> </ul>   |                                      |        |
| <b>授業計画 Course Schedule</b>                | <ol style="list-style-type: none"> <li>1. Introduction: Importance of corrosion phenomena and corrosion protection.</li> <li>2. Theories in corrosion science: Local cell model of corrosion reaction, the kinetics of electrode reaction, thermodynamics of the corrosion phenomena and Pourbaix diagrams, the concept of passivity, determination methods of corrosion rate including Tafel's law, DC polarization method and AC impedance method.</li> <li>3. Classification of practical corrosion: Characteristics of uniform corrosion, galvanic corrosion, crevice corrosion, pitting corrosion, grain boundary corrosion, selective corrosion, erosion-corrosion, stress corrosion cracking, hydrogen embrittlement, and high-temperature corrosion.</li> <li>4. Corrosive environments: Characteristics of various corrosion environments as moisture (water system), air, soil, concrete, (micro)bio-system, dew point corrosion, corrosion in oil and natural gas, corrosion inside the electronic devices, and so on.</li> <li>5. Corrosion protection: Corrosion resistive materials (characteristics of carbon steel, low-alloy steels, stainless steels, titanium, aluminum, copper, and amorphous alloys), methodological approaches (coating, lining, and inhibitors).</li> </ol> |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | Students are expected to read the text booklet before and after the lecture. Students are also required to put in a report for every lecture.  |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Reports (homework is given at each lecture) (60%), contribution to the discussion at the class (40%).  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  | Textbook will be provided via ftp site that will be announced at the beginning of the class.   |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G066">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G066</a>   |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <a href="https://www.eng.hokudai.ac.jp/labo/eleamat/index.html">https://www.eng.hokudai.ac.jp/labo/eleamat/index.html</a>  |                                      |        |
| <b>備考 Additional Information</b>           | Basic knowledge of thermodynamics and electrochemistry are required.<br>The class may be held on-line depending on the COVID-19 related situation.   |                                      |        |

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| 科目名 Course Title                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]   |                               |        |
| 講義題目 Subtitle                       | Leading and Advanced Biological and Polymer Chemistry and Engineering IA - 2022   |                               |        |
| 責任教員 Instructor                     | 坂口 和靖 [SAKAGUCHI Kazuyasu] (大学院理学研究院)   |                               |        |
| 担当教員 Other Instructors              | 鎌田 瑠泉 [KAMADA Rui] (理学研究院)  |                               |        |
| 科目種別 Course Type                    | Adrian SEROHJOS (University of Montreal)  |                               |        |
| 開講年度 Year                           | 2022  | 時間割番号 Course Number           | 095134 |
| 期間 Semester                         | 通年不定期   | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class                  | 講義  | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class  |   |                               |        |
| ナンバリングコード Numbering Code            | CHEM_REQEL 7121   |                               |        |
| 補足事項 Other Information              |   |                               |        |
| <b>キーワード Key Words</b>              | protein evolution, microbial evolution, drug resistance, fitness landscape, protein engineering, evolutionary biology, population genetics, stochastic processes  |                               |        |
| <b>授業の目標 Course Objectives</b>      | <ol style="list-style-type: none"> <li>1. To establish protein evolution as a dynamic process that is a consequence of both biochemistry and evolutionary biology</li> <li>2. To establish how protein evolution is affected population structure and ecology of microbes</li> <li>3. To introduce state-of-the art protein engineering approaches to study the genotype-phenotype relationship in microbes</li> <li>4. To introduce integrative models of microbial evolution derived from protein biophysics</li> <li>5. To demonstrate the application of these models in predicting how microbes evolve resistance against antibiotics and how viruses evolve against antibodies</li> </ol>   |                               |        |
| <b>到達目標 Course Goals</b>            | <ol style="list-style-type: none"> <li>1. To achieve an appreciation protein evolution as a dynamic stochastic process</li> <li>2. To appreciate how protein evolution is govern by factors at different scales of biological organization (sequence, 3D structure, cellular system, population dynamics, and ecology)</li> <li>3. To appreciate the state-of-the art experimental techniques in protein engineering, microfluidics, and microbial evolution</li> <li>4. To appreciate how emerging integrative models of protein evolution are applied predict how bacteria and viruses evolve</li> </ol>  |                               |        |
| <b>授業計画 Course Schedule</b>         | <p>Lecture 1: Fundamental concepts in protein and microbial evolution<br/> Readings: Berhstein et al. Curr Opin Struct Biol. 2017, 42:31-40; Serohijos et al. Curr Opin Struct Biol. 2014, 26:84-91; Serohijos et al., Biophys J. 2013, 104(3):L1-3.</p> <ul style="list-style-type: none"> <li>・ Fitness landscapes</li> <li>・ Mutational drift, selection, and population size</li> <li>・ Emerging universal results in protein evolution</li> </ul> <p>Lecture 2: High-throughput protein engineering to determine adaptive fitness landscapes<br/> Readings: Fowler, Nat Methods. 2014, 11(8):801-7; Fowler, Nat Protoc. 2014, 9(9):2267-84.</p> <ul style="list-style-type: none"> <li>・ Deep mutational scans (Comprehensive mutagenesis, selection, and next-gen sequencing)</li> </ul> <p>Lecture 3: Predicting the evolution of microbes against antibiotics and of viruses against antibodies<br/> Readings: Rotem, Mol Biol Evol. 2018, 35(10):2390-2400.</p> <ul style="list-style-type: none"> <li>・ Integrative models of protein evolution</li> <li>・ High-throughput evolution in droplet-based microfluidics</li> </ul> <p>Lecture 4: Chromosomal single cell barcoding to determine the dynamics of microbial evolution<br/> Readings: Lerner, Biorxiv (<a href="https://doi.org/10.1101/571505">https://doi.org/10.1101/571505</a>); Levy, Nature. 2015, 519(7542):181-6; Venkataram, Cell. 2016, 166(6):1585-1596.</p> <ul style="list-style-type: none"> <li>・ Single-cell barcoding</li> <li>・ Clonal interference</li> <li>・ Microbiome evolution</li> <li>・ Integrative models of protein evolution</li> <li>・ High-throughput evolution in droplet-based microfluidics</li> </ul> <p>Lecture 4: Chromosomal single cell barcoding to determine the dynamics of microbial evolution<br/> Readings: Lerner, Biorxiv (<a href="https://doi.org/10.1101/571505">https://doi.org/10.1101/571505</a>); Levy, Nature. 2015, 519(7542):181-6; Venkataram, Cell. 2016, 166(6):1585-1596.</p> <ul style="list-style-type: none"> <li>・ Single-cell barcoding</li> <li>・ Clonal interference</li> <li>・ Microbiome evolution</li> </ul> |                               |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b> | Read the articles in the "Reading List"   |                               |        |

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| <p><b>成績評価の基準と方法 Grading System</b></p> <p>Assignment on specified topics regarding "protein evolution" and "microbial evolution" (60%); Student participation in class discussion (40%)</p>   |
| <p><b>他学部履修の条件 Other Faculty Requirements</b></p>  |
| <p><b>テキスト・教科書 Textbooks</b></p> <p>None</p>   |
| <p><b>講義指定図書 Reading List</b></p> <p>Reading list:<br/> Berhstein et al. Curr Opin Struct Biol. 2017, 42:31-40; Serohijos et al. Curr Opin Struct Biol. 2014, 26:84-91; Serohijos et al., Biophys J. 2013, 104(3):L1-3; Fowler, Nat Methods. 2014, 11(8):801-7; Rotem, Mol Biol Evol. 2018, 35(10):2390-2400; Lerner, Biorxive (<a href="https://doi.org/10.1101/571505">https://doi.org/10.1101/571505</a>); Levy, Nature. 2015, 519(7542):181-6; Venkataram, Cell. 2016, 166(6):1585-1596.</p> |
| <p><b>参照ホームページ Websites</b></p> <p>This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;<br/> <a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G056">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G056</a></p>  |
| <p><b>研究室のホームページ Websites of Laboratory</b></p> <p><a href="https://wwwchem.sci.hokudai.ac.jp/~biochem/">https://wwwchem.sci.hokudai.ac.jp/~biochem/</a><br/> <a href="http://www.serohijoslab.org/">http://www.serohijoslab.org/</a></p>  |
| <p><b>備考 Additional Information</b></p> <p>Other Instructor: Adrian SEROHIJOS (University of Montreal)</p>   |

|  |   |                                      |        |
|--|---|--------------------------------------|--------|
| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]   |                                      |        |
| <b>講義題目 Subtitle</b>                       | Leading and Advanced Biological and Polymer Chemistry and Engineering IB - 2022   |                                      |        |
| <b>責任教員 Instructor</b>                     | 磯野 拓也 [ISONO Takuya] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | Redouane BORSALI (Grenoble Alpes University, CERMAV-CNRS), 佐藤 敏文 [SATOHI Toshifumi](工学研究院)  |                                      |        |
| <b>科目種別 Course Type</b>                    |   |                                      |        |
| <b>開講年度 Year</b>                           | 2022  | <b>時間割番号 Course Number</b>           | 095135 |
| <b>期間 Semester</b>                         | 通年不定期   | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義  | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |   |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121   |                                      |        |
| <b>補足事項 Other Information</b>              |   |                                      |        |
| <b>キーワード Key Words</b>                     | Self-assembly, block copolymers, nanoparticles, thin films, nanolithography, electronic devices   |                                      |        |
| <b>授業の目標 Course Objectives</b>             | The objectives of the course is to give a comprehensive lecture on self-assembly : from theory to experimental procedures and data analysis - this lecture will describe the concept of self-assembly of block copolymer systems allowing to fabricate nanoparticles and nanostructured thin films.   |                                      |        |
| <b>到達目標 Course Goals</b>                   | To date, numerous studies have been made on the self-assembly of petroleum-based block copolymers for potential applications in multidisciplinary fields, such as nanoparticles for drug delivery, biosensor, nanolithography, etc. Such materials are derived from fossil resources that are being rapidly depleted and have negative environmental impacts. In contrast, carbohydrates are abundant, renewable and constitute a sustainable source of materials. This is currently attracting much interest in various sectors and their industrial applications at the nanoscale level will have to expand quickly in response to the transition to a bio-based economy. To this end and to meet the challenge of the 21st century, that will hopefully open new horizons for the valorization of bio-sourced functional materials at the nanoscale level. The goals of this lecture is to give routes on how to design and develop, using environmentally friendly processes, glyconanoparticles and ultra-high resolution patterned nano-organized films, obtained via the self-assembly of elementary bricks of plant-based biomaterials (glycopolymers) for innovative high-added value applications (nanolithography, flexible opto-electronic devices, smart surfaces, ...). |                                      |        |
| <b>授業計画 Course Schedule</b>                | 1st lecture: Overview of synthesis and characterization of block copolymer<br>2nd lecture: Self-assembly concept of block copolymer<br>3rd lecture: Self-assemblies of block copolymer systems: Nanoparticles (1)<br>4th lecture: Self-assemblies of block copolymer systems: Nanoparticles (2)<br>5th lecture: Self-assemblies of block copolymer systems: Thin Films (1)<br>6th lecture: Self-assemblies of block copolymer systems: Thin Films (2)<br>7th lecture: Discussion about self-assemblies of block copolymer systems<br>8th Seminar: Nanoparticles and ultra high resolution thin films for industrial applications  |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | Final report regarding to "SELF-ASSEMBLIES BLOCK COPOLYMER SYSTEMS"   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Your grade will be determined by how well you demonstrate your achievement of the course goals through<br>1. Participation to the discussion (10%)<br>2. Final report regarding to "SELF-ASSEMBLIES BLOCK COPOLYMER SYSTEMS" (90%)  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  | Lecture notes in PDF files will be provided.  |                                      |        |
| <b>講義指定図書 Reading List</b>                 | Developments in Block Copolymer Science and Technology 1st Edition / Ian W. Hamley (Editor): John Wiley & Sons, Ltd, 2004<br>Structure and Dynamics of Polymers and Colloids / R. Borsali and R. Pecora (Editors): Kluwer Publisher, 2002<br>3) C. Giacomelli, V. Schmidt, K. Aissou & R. Borsali «Block Copolymer Systems: From Single Chain to Self-Assembled Nanostructures» Langmuir (Invited Feature Article), 26 (20), 2010, 15734-15744;<br>4)1. Y. Liao, W.-C.Chen, R. Borsali* «Carbohydrate-Based Block Copolymer Thin Films: Ultrafast Nano-Organization with 7 nm Resolution Using Microwave Energy» Adv. Mater., 2017, First published: 6 July 2017, DOI: 10.1002/adma.201701645).   |                                      |        |

**参照ホームページ Websites**

This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;

<https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G057>

**研究室のホームページ Websites of Laboratory**

<https://www.cermav.cnrs.fr/language/en/the-teams/physico-chemistry-and-self-assembly-of-glycopolymers/>

[http://poly-ac.eng.hokudai.ac.jp/index\\_e.html](http://poly-ac.eng.hokudai.ac.jp/index_e.html)

**備考 Additional Information**

Other Instructor: Redouane BORSALI (Grenoble Alpes University, CERMAV-CNRS)

The class will be held on campus and/or in real-time web system.

We will announce the details via ELMS. Please carefully see ELMS.

|  |   |                                      |        |
|--|---|--------------------------------------|--------|
| <b>科目名 Course Title</b>  | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]             |                                      |        |
| <b>講義題目 Subtitle</b>   | Leading and Advanced Biological and Polymer Chemistry and Engineering II - 2022 |                                      |        |
| <b>責任教員 Instructor</b>   | 佐藤 敏文 [SATO Toshiyuki] (大学院工学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>  | Guey-Sheng LIOU (National Taiwan University), 磯野 拓也 [ISONO Takuya] (工学研究院)      |                                      |        |
| <b>科目種別 Course Type</b>  |   |                                      |        |
| <b>開講年度 Year</b>   | 2022  | <b>時間割番号 Course Number</b>           | 095136 |
| <b>期間 Semester</b>   | 通年不定期   | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>  | 講義  | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |   |                                      |        |
| <b>ナンバリングコード Numbering Code</b>  | CHEM_REQEL 7121   |                                      |        |
| <b>補足事項 Other Information</b>  |   |                                      |        |
| <b>キーワード Key Words</b>   |   |                                      |        |
| Step-Growth Polymerization, functional polymers, high-performance polymers/metal oxides hybrids, triphenylamine (TPA), optical, electrochromic, and optoelectronic applications.   |   |                                      |        |
| <b>授業の目標 Course Objectives</b>   |   |                                      |        |
| The purpose of this course is to train graduate students to be familiar with the terminologies of polymer science and to be knowledgeable about polymer research and development. Since polymer materials are central for the current advances of many industrial areas including plastics/elastomers, conducting materials, optoelectronics, biomaterials, drugs, etc., the young researchers are required to learn the correlation between polymer structures and emerging technologies. Another purpose of the lectures is to stimulate students to think creatively and to be able of connecting and integrating their learnt knowledge to new developments for future academic and industrial research.   |   |                                      |        |
| <b>到達目標 Course Goals</b>   |   |                                      |        |
| This course aims to be a comprehensive, authoritative, and general interest to the polymer chemistry and provides the understanding on (i) high-performance polymers and their representative nanocomposites (ii) specific functionality and its relations to molecular structures, and characterization skills of these advanced functional polymers.<br>Get knowledge on (1) How to prepare and characterize the high-performance polymers and their hybrid films via sol-gel approaches and their related application; (2) A variety of strategies and approaches for obtaining the high-performance polymers with different specific functions; (3) The characterizations and relationships between the structural units and functions in the polymer chains and the investigation of some advanced applications in terms of their unique functionality. Overall, to build up the background in polymers with a structure of distinct functional groups (responsive to a stimulus) which may consequently express unique physical or chemical properties and additional functions from synthesis to practical applications; from chemistry to physics (optics and electronics) and different applications. |   |                                      |        |
| <b>授業計画 Course Schedule</b>  |   |                                      |        |
| 1st lecture: Fundamental concept/meaning of polymer chemical structures via different Step-Growth Polymerizations for building up the background in polymers with a structure of distinct functional groups (responsive to a stimulus)   |   |                                      |        |
| 2nd lecture: High performance and specialty polymers in aspects of polymerization and structural design for various specific functional materials from synthesis to practical applications   |   |                                      |        |
| 3rd lecture: Strategies and approaches for obtaining the high-performance polymers for electronic, optoelectronic and different applications from chemistry to physics (optics and electronics)  |   |                                      |        |
| 4th lecture: Polymer/nanoparticle hybrids for optical, electrochromic, and optoelectronic applications   |   |                                      |        |
| Seminar: lectures: Redox-Active and AIE-Active Functional Materials for Optoelectronic Applications  |   |                                      |        |
| Covers and summarizes the fundamentals of representative high-performance polymers in conjunction with recent development of triphenylamine (TPA)-based advanced materials for various optoelectronic applications, such as electrochromic, electrofluorochromic, and polymeric memory devices that are also appealing to those who are interested in the general areas of photo-physical chemistry, electrochemistry, polymer chemistry, as well as their practical applications.   |   |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>  |   |                                      |        |
| Final report regarding to regarding to "Design, Synthesis and Applications of Functional Polymers via Step-Growth Polymerization".   |   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>   |   |                                      |        |
| Your grade will be determined by how well you demonstrate your achievement of the course goals through   |   |                                      |        |
| 1. Participation to the discussion (10%)   |   |                                      |        |
| 2. Final report regarding to "Design, Synthesis and Applications of Functional Polymers via Step-Growth Polymerization" (90%)  |   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>   |   |                                      |        |
| <b>テキスト・教科書 Textbooks</b>  |   |                                      |        |
| Lecture notes in PDF files will be provided.   |   |                                      |        |

**講義指定図書 Reading List**

Design and preparation of triphenylamine-based polymeric materials towards emergent optoelectronic applications (Prog. Polym. Sci., 89, 250-287 (2019))

Highly transparent polyimide hybrids for optoelectronic applications (React. Funct. Polym., 2016, 108, 2-30)

Triarylaminebased high-performance polymers for resistive switching memory devices (Polymer Journal, 2016, 48, 117-138)

**参照ホームページ Websites**

This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below;

<https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G058>

**研究室のホームページ Websites of Laboratory**

<http://www.pse.ntu.edu.tw/members/bio.php?PID=6>

[http://poly-ac.eng.hokudai.ac.jp/index\\_e.html](http://poly-ac.eng.hokudai.ac.jp/index_e.html)

**備考 Additional Information**

Other Instructor: Guey-Sheng LIOU (National Taiwan University)

The class is opened on campus and/or in real-time web system.

Please carefully see ELMS.



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|--|--|--------------------------------------|--------|
| <b>科目名 Course Title</b>                    | 先端総合化学特論Ⅱ [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Advanced Applied Biochemistry [Advanced Applied Biochemistry]  |                                      |        |
| <b>責任教員 Instructor</b>                     | 松本 謙一郎 [MATSUMOTO Kenichiro] (大学院工学研究院)  |                                      |        |
| <b>担当教員 Other Instructors</b>              | 藤田 雅弘 [FUJITA Masahiro] (理化学研究所), 富田 宏矢 [TOMITA Hiroya] (工学研究院)  |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095137 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | Genetic information, protein structure, molecular mechanism, biosynthetic mechanism, animal cells, secondary metabolites, biopolymers, bioremediation, physical chemistry  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | To learn synthesis, structure, function, and novel engineering subjects on of biomolecules in the fields of life science, information, medicine, and environment.  |                                      |        |
| <b>到達目標 Course Goals</b>                   | Students are expected to understand deeply the topics of genetic information, protein structure, animal cell cultivation, secondary metabolites, biopolymers, and clean environments in the fields of life science, information, medicine, and environment.  |                                      |        |
| <b>授業計画 Course Schedule</b>                | 1-4: Structure, function and analytical methods of RNA and other biomolecules<br>5-8: Strategies of metabolic pathways, and principles of enzymatic reactions  |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | Students review the lecture contents by the next time. Students submit a report after the lecture.   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | Active class participation and reports<br>The attendance rate must be over 70% to be qualified to be graded.   |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |  |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G061">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G061</a> |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   | <a href="https://biosynchem.eng.hokudai.ac.jp/">https://biosynchem.eng.hokudai.ac.jp/</a>  |                                      |        |
| <b>備考 Additional Information</b>           |  |                                      |        |

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|--|--|--------------------------------------|--------|
| <b>科目名 Course Title</b>                    | 先端総合化学特論 II [Modern Trends in Chemical Sciences and Engineering II]  |                                      |        |
| <b>講義題目 Subtitle</b>                       | Introduction to Basic Biological Chemistry[Introduction to Basic Biological Chemistry]   |                                      |        |
| <b>責任教員 Instructor</b>                     | 村上 洋太 [MURAKAMI Yota] (大学院理学研究院)   |                                      |        |
| <b>担当教員 Other Instructors</b>              | 高岡 晃教[TAKAOKA Akinori](遺伝子病制御研究所), 茂木 文夫[MOTEGI Fumio](遺伝子病制御研究所)  |                                      |        |
| <b>科目種別 Course Type</b>                    |  |                                      |        |
| <b>開講年度 Year</b>                           | 2022   | <b>時間割番号 Course Number</b>           | 095138 |
| <b>期間 Semester</b>                         | 通年不定期  | <b>単位数 Number of Credits</b>         | 1      |
| <b>授業形態 Type of Class</b>                  | 講義   | <b>対象年次 Year of Eligible Student</b> | ～      |
| <b>対象学科・クラス Eligible Department/Class</b>  |  |                                      |        |
| <b>ナンバリングコード Numbering Code</b>            | CHEM_REQEL 7121  |                                      |        |
| <b>補足事項 Other Information</b>              |  |                                      |        |
| <b>キーワード Key Words</b>                     | 細胞増殖と分化、遺伝子発現、エピジェネティクス、がん遺伝子、免疫、感染症、細胞非対称性  |                                      |        |
| <b>授業の目標 Course Objectives</b>             | 細胞増殖、細胞分化、免疫、細胞の非対称性などの生命現象を対象に、その制御機構の分子基盤について講義をおこなう。さらにこれらの制御機構の乱れがどのようにがんを含む疾患の原因となるかについても議論する。さらに、細胞内分子の動態をイメージングするためのテクノロジーについても紹介する。  |                                      |        |
| <b>到達目標 Course Goals</b>                   | 遺伝子発現、細胞増殖、免疫、細胞非対称性の制御機構の基礎を理解し、それらに関連する疾病の発生原理を理解する。   |                                      |        |
| <b>授業計画 Course Schedule</b>                | 1 日目, 2 日目:村上洋太<br>遺伝子発現と細胞分化の制御機構<br>3 日目:高岡晃教<br>生体防御機構におけるシグナル伝達の分子基盤<br>4 日目:茂木文夫<br>細胞非対称性のインテリアデザイン  |                                      |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>        | 毎回の講義内容を次回までに復習しておくこと。   |                                      |        |
| <b>成績評価の基準と方法 Grading System</b>           | 課題についてのレポート提出(100%)  |                                      |        |
| <b>他学部履修の条件 Other Faculty Requirements</b> |  |                                      |        |
| <b>テキスト・教科書 Textbooks</b>                  |  |                                      |        |
| <b>講義指定図書 Reading List</b>                 |  |                                      |        |
| <b>参照ホームページ Websites</b>                   | This course will be provided as part of the Hokkaido Summer Institute., For more information (invited lecturers, course details, etc.), please visit the website below:<br><a href="https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G059">https://hokkaidosummerinstitute.oia.hokudai.ac.jp/en/courses/CourseDetail=G059</a> |                                      |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |  |                                      |        |
| <b>備考 Additional Information</b>           |  |                                      |        |

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| 科目名 Course Title   | 総合化学特別研究第二[Research in Chemical Sciences and Engineering II] |                               |        |
| 講義題目 Subtitle  |  |                               |        |
| 責任教員 Instructor  | 村上 洋太 [MURAKAMI Yota] (大学院理学研究院)                             |                               |        |
| 担当教員 Other Instructors   |  |                               |        |
| 科目種別 Course Type   |  |                               |        |
| 開講年度 Year  | 2022   | 時間割番号 Course Number           | 095151 |
| 期間 Semester  | 通年不定期  | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class   | 講義   | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class   |  |                               |        |
| ナンバリングコード Numbering Code   | CHEM_REQEL 7131  |                               |        |
| 補足事項 Other Information   |  |                               |        |
| <b>キーワード Key Words</b>   |  |                               |        |
| 物理化学, 無機分析化学, 有機化学, 生物化学, 物質化学, 有機プロセス工学, 生物機能高分子  |  |                               |        |
| <b>授業の目標 Course Objectives</b>   |  |                               |        |
| 外国人を主体とした研究者(ゲストスピーカー)による主に英語での最先端の専門領域研究についての講演を講義に取り入れ, 国際的な研究活動を行うために必要な能力を養う。  |  |                               |        |
| <b>到達目標 Course Goals</b>   |  |                               |        |
| 複数の外国人ゲストスピーカーに化学の様々な分野における最先端の研究成果を英語で紹介してもらうことにより, 化学研究における国際的感覚を養う。英語で討議を行うことにより, 国際会議等におけるディスカッション能力を養う。   |  |                               |        |
| <b>授業計画 Course Schedule</b>  |  |                               |        |
| 以下に示す化学の幅広い分野において, 先端的な研究を展開している外国人研究者より直接英語で講義を受け, 広い視野を身につける。各講義において英語によるディスカッションを行い, 国際研究発表の場において相手の考えを理解し, 自分の考えを論理的に説明する能力を身につける。   |  |                               |        |
| <ol style="list-style-type: none"> <li>1. 物理化学領域(理論化学, 表面科学, 分光学, 電気化学, 触媒化学, クラスタ化学)</li> <li>2. 無機分析化学領域(希土類, アクチノイド, 光化学, 錯体化学)</li> <li>3. 有機化学領域(有機構造化学, 合成化学, 天然物化学, 有機金属化学, 生物活性天然物)</li> <li>4. 生物化学領域(タンパク質の機能と制御, 生命現象の分子機構, 生物物理化学)</li> <li>5. 物質化学領域(セラミックス, 炭素材料, 複合材料の設計, エネルギー材料)</li> <li>6. 有機プロセス工学領域(有機材料, 有機工業化学, 化学工学, 反応工学)</li> <li>7. 生物機能高分子領域(生物工学, 機能化学, 動物細胞工学, バイオテクノロジー)</li> </ol> |  |                               |        |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>   |  |                               |        |
| 講演内容について疑問を残さないように, 講演終了後に講師に質疑を行う。  |  |                               |        |
| <b>成績評価の基準と方法 Grading System</b>   |  |                               |        |
| 原則として, 学修態度(20%), レポート(80%)によって評価する。   |  |                               |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>   |  |                               |        |
| <b>テキスト・教科書 Textbooks</b>  |  |                               |        |
| <b>講義指定図書 Reading List</b>   |  |                               |        |
| <b>参照ホームページ Websites</b>   |  |                               |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |  |                               |        |
| <b>備考 Additional Information</b>   |  |                               |        |

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| 科目名 Course Title   | 総合化学研究インターンシップ[Internship]          |                               |        |
| 講義題目 Subtitle  | ショート・ビジット[Short Visit]              |                               |        |
| 責任教員 Instructor  | 仙北 久典 [SENBOKU Hisanori] (大学院工学研究院) |                               |        |
| 担当教員 Other Instructors   |                                     |                               |        |
| 科目種別 Course Type   |                                     |                               |        |
| 開講年度 Year  | 2022                                | 時間割番号 Course Number           | 095161 |
| 期間 Semester  | 通年不定期                               | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class   | インターンシップ                            | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class   |                                     |                               |        |
| ナンバリングコード Numbering Code   | CHEM_REQEL 7141                     |                               |        |
| 補足事項 Other Information   |                                     |                               |        |
| <b>キーワード Key Words</b>   |                                     |                               |        |
| 海外インターンシップ   |                                     |                               |        |
| <b>授業の目標 Course Objectives</b>   |                                     |                               |        |
| 海外インターンシップにおいて、国際的視野を養い、国内では得ることのできない専門知識や技術を習得する。   |                                     |                               |        |
| <b>到達目標 Course Goals</b>   |                                     |                               |        |
| 海外インターンシップにおいて、派遣先との交渉から始まりコミュニケーション能力、語学力、研究実践力、研究ネットワーク・コミュニティ形成力等を向上させ、技術者あるいは研究者としての意識を高める。<br>派遣先での経験を基礎的な学習に留めず、実践レベルの共同研究へ発展させる。  |                                     |                               |        |
| <b>授業計画 Course Schedule</b>  |                                     |                               |        |
| おおよそ以下のスケジュールで実施する。  |                                     |                               |        |
| <ol style="list-style-type: none"> <li>1. 募集告知</li> <li>2. 申請(履修登録ではない)</li> <li>3. 準備</li> <li>4. インターンシップの実施(2週間～2ヶ月)</li> <li>5. インターンシップ終了後:成果報告書(レポート)の提出, 報告会</li> </ol> |                                     |                               |        |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>   |                                     |                               |        |
| インターンシップ前に事前研修の一部として、各自研修先に応じた予備調査や実験準備を行う。  |                                     |                               |        |
| <b>成績評価の基準と方法 Grading System</b>   |                                     |                               |        |
| 原則として、研修終了後に学修成果に関する英語によるレポートの提出を課し、プログラム報告会において英語による学修成果の発表を行い、レポート提出と報告会での発表により評価を行う。  |                                     |                               |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>   |                                     |                               |        |
|  |                                     |                               |        |
| <b>テキスト・教科書 Textbooks</b>  |                                     |                               |        |
| 使用しない  |                                     |                               |        |
| <b>講義指定図書 Reading List</b>   |                                     |                               |        |
| 使用しない  |                                     |                               |        |
| <b>参照ホームページ Websites</b>   |                                     |                               |        |
|  |                                     |                               |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |                                     |                               |        |
|  |                                     |                               |        |
| <b>備考 Additional Information</b>   |                                     |                               |        |
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| 科目名 Course Title   | 総合化学研究インターンシップ[Internship]          |                               |        |
| 講義題目 Subtitle  | ALP インターンシップ[ALP Internship]        |                               |        |
| 責任教員 Instructor  | 仙北 久典 [SENBOKU Hisanori] (大学院工学研究院) |                               |        |
| 担当教員 Other Instructors   |                                     |                               |        |
| 科目種別 Course Type   |                                     |                               |        |
| 開講年度 Year  | 2022                                | 時間割番号 Course Number           | 095162 |
| 期間 Semester  | 通年不定期                               | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class   | インターンシップ                            | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class   |                                     |                               |        |
| ナンバリングコード Numbering Code   | CHEM_REQEL 7142                     |                               |        |
| 補足事項 Other Information   |                                     |                               |        |
| <b>キーワード Key Words</b>   |                                     |                               |        |
| 国内・海外インターンシップ, 就業体験  |                                     |                               |        |
| <b>授業の目標 Course Objectives</b>   |                                     |                               |        |
| ALP 企業インターンシップ: 企業・団体等において自らの専攻や将来のキャリアに関連した就業体験を行い, 実社会に触れることによる学習意欲の向上や職業観・勤労観の育成を行う。  |                                     |                               |        |
| ALP 海外インターンシップ: 国際的視野を養い, 国内では得ることのできない専門知識や技術を習得する。   |                                     |                               |        |
| <b>到達目標 Course Goals</b>   |                                     |                               |        |
| 派遣先との交渉から始まり, コミュニケーション能力, 語学力, 研究実践力, 研究ネットワーク・コミュニティ形成力等を向上させ, 技術者あるいは研究者としての就業意識を高める。   |                                     |                               |        |
| 海外インターンシップにおいては, 派遣先での経験を基礎的な学習に留めず, 実践レベルの共同研究へ発展させる。   |                                     |                               |        |
| <b>授業計画 Course Schedule</b>  |                                     |                               |        |
| ALP 企業インターンシップ   |                                     |                               |        |
| <ul style="list-style-type: none"> <li>派遣期間: 原則として2週間以上 12 ヶ月以内とする。</li> <li>派遣先: 国内の企業等の研究所および工場など。</li> <li>原則インターンシップ出発日の4週間前までに申請を行うこと。</li> <li>出張前に, 必ず学研災などの保険への加入を完了しておくこと。</li> </ul>   |                                     |                               |        |
| ALP 海外インターンシップ   |                                     |                               |        |
| <ul style="list-style-type: none"> <li>派遣期間: 原則として1 ヶ月以上 12 ヶ月以内とする。</li> <li>派遣先: 大学を主とした研究機関, および企業。</li> <li>原則インターンシップ出発日の6週間前までに申請手続きを行うこと。</li> <li>渡航前に, 必ず旅行者保険への加入を完了しておくこと。</li> </ul> |                                     |                               |        |
| 企業インターンシップと海外インターンシップのいずれにおいても終了後1ヶ月以内に報告書を提出すること。   |                                     |                               |        |
| <b>準備学習 (予習・復習)等の内容と分量 Homework</b>  |                                     |                               |        |
| インターンシップ前に事前研修の一部として, 各自研修先に応じた予備調査や実験準備を行う。   |                                     |                               |        |
| <b>成績評価の基準と方法 Grading System</b>   |                                     |                               |        |
| 原則として, 研修終了後に学修成果に関する報告書の提出を課し, プログラム報告会において学修成果の発表を行い(海外インターンシップの場合は英語による), 報告書提出と報告会での発表により評価を行う。  |                                     |                               |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>   |                                     |                               |        |
| ALP 生のみ履修可。  |                                     |                               |        |
| <b>テキスト・教科書 Textbooks</b>  |                                     |                               |        |
| 使用しない。   |                                     |                               |        |
| <b>講義指定図書 Reading List</b>   |                                     |                               |        |
| 使用しない。   |                                     |                               |        |
| <b>参照ホームページ Websites</b>   |                                     |                               |        |
| <a href="https://phdiscover.jp/hu/alp/">https://phdiscover.jp/hu/alp/</a>  |                                     |                               |        |
| <b>研究室のホームページ Websites of Laboratory</b>   |                                     |                               |        |
|  |                                     |                               |        |
| <b>備考 Additional Information</b>   |                                     |                               |        |
| ALP 生のみが履修登録可能です。  |                                     |                               |        |

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|---|---|-------------------------------|--------|
| 科目名 Course Title  | 総合化学研究インターンシップ[Internship]  |                               |        |
| 講義題目 Subtitle   | ジョブ型研究インターンシップ[Cooperative Education through Research Internship] |                               |        |
| 責任教員 Instructor   | 仙北 久典 [SENBOKU Hisanori] (大学院工学研究院)                               |                               |        |
| 担当教員 Other Instructors  |   |                               |        |
| 科目種別 Course Type  |   |                               |        |
| 開講年度 Year   | 2022  | 時間割番号 Course Number           | 095163 |
| 期間 Semester   | 通年不定期   | 単位数 Number of Credits         | 1      |
| 授業形態 Type of Class  | インターンシップ  | 対象年次 Year of Eligible Student | ～      |
| 対象学科・クラス Eligible Department/Class  |   |                               |        |
| ナンバリングコード Numbering Code  | CHEM_REQEL 7142   |                               |        |
| 補足事項 Other Information  |   |                               |        |
| <b>キーワード Key Words</b>  |   |                               |        |
| 国内就業体験  |   |                               |        |
| <b>授業の目標 Course Objectives</b>  |   |                               |        |
| 企業・団体等において自らの専攻や将来のキャリアに関連した就業体験を行い、実社会に触れることによる学習意欲の向上や職業観・勤労観の育成を行う。  |   |                               |        |
| <b>到達目標 Course Goals</b>  |   |                               |        |
| 派遣先との交渉から始まり、コミュニケーション能力、語学力、研究実践力、研究ネットワーク・コミュニティ形成力等を向上させ、技術者あるいは研究者としての就業意識を高める。   |   |                               |        |
| <b>授業計画 Course Schedule</b>   |   |                               |        |
| おおよそ以下のスケジュールで実施する。   |   |                               |        |
| <ol style="list-style-type: none"> <li>1. 募集告知</li> <li>2. 申請(履修登録ではない)</li> <li>3. 準備</li> <li>4. インターンシップの実施(2週間～2ヶ月)</li> <li>5. インターンシップ終了後:成果報告書(レポート)の提出</li> </ol> |   |                               |        |
| <b>準備学習(予習・復習)等の内容と分量 Homework</b>  |   |                               |        |
| インターンシップ前に事前研修の一部として、各自研修先に応じた予備調査や実験準備を行う。   |   |                               |        |
| <b>成績評価の基準と方法 Grading System</b>  |   |                               |        |
| 原則として、研修終了後に学修成果に関するレポートの提出を課す。   |   |                               |        |
| <b>他学部履修の条件 Other Faculty Requirements</b>  |   |                               |        |
|   |   |                               |        |
| <b>テキスト・教科書 Textbooks</b>   |   |                               |        |
| 使用しない   |   |                               |        |
| <b>講義指定図書 Reading List</b>  |   |                               |        |
| 使用しない   |   |                               |        |
| <b>参照ホームページ Websites</b>  |   |                               |        |
| <a href="https://coopj-intern.com/">https://coopj-intern.com/</a>   |   |                               |        |
| <b>研究室のホームページ Websites of Laboratory</b>  |   |                               |        |
|   |   |                               |        |
| <b>備考 Additional Information</b>  |   |                               |        |
| 文部科学省「ジョブ型研究インターンシップ」参加者のみが履修登録可能です。  |   |                               |        |