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| **113(2)/2025 Spring Semester TIGP-ESS課程資料表**  **113(2)/2025 Spring Semester TIGP-ESS course information form** | |
| 科目名稱(中文) | 環境同位素地球化學 |
| Course Title (English) | Environmental Isotope Geochemistry |
| 授課時間  Time | Wednesday 9 a.m. – 12 a.m. |
| 授課地點  Location | IES R611 |
| 學分數  Course Credits | 3 |
| 主要授課老師 Main Instructors | Dr. Kuo-Fang Huang & Dr. Ming-Tsung Chung |
| 聯絡郵件  E-mail | [kfhuang@earth.sinica.edu.tw](mailto:kfhuang@earth.sinica.edu.tw) (Dr. Kuo-Fang Huang)  [mingtsungchung@ntu.edu.tw](mailto:mingtsungchung@ntu.edu.tw) (Dr. Ming-Tsung Chung) |
| 辦公時間 Office Hours | By appointment |
| 課程目標 Course Objectives | Students of this course will learn:   1. Basic principles of isotope geochemistry in environmental studies 2. Distribution, cycling and transport of trace elements and their isotopes on Earth surface   Novel applications of Environmental isotope geochemistry |
| 授課內容 Course Description | This course will provide up-to-date information on the range of new isotopic tools that are being developed and utilized to investigate environmental studies, including continental and aquatic processes, biological processes, atmospheric processes, environmental forensics, as well as paleoclimate and paleo-environments. Students will be asked to examine their own thoughts/opinions on the topics and given their oral/written presentations for the mid-term and final exams. |
| 教科書/參考書 Textbooks/References | 1. Handbook of Environmental Isotope Geochemistry   *Mark Baskaran*   1. Non-Traditional Stable Isotopes: Retrospective and Prospective   *Fang-Zhen Teng, Nicolas Dauphas and James M. Watkins*   1. Stable Isotope Ecology   *Brian Fry* |
| 自編教材比例  Self-compiled Textbook/References Proportion (if any) | (限數字 0~100) |
| 授課方式 Course Requirements | ■講授(Lecture)；  □研討(Seminar)；  □實習/實驗(Internship/Experiment)；  □個別指導(Individual Discussion)；  ■其他(Other) |
| 評量配分比重 Course Grade | Performance in Class 30%  Assignments 20%  Oral Presentation 20%  Term Project (in the form of oral and written presentations) 30% |
| 對應之永續發展目標(SDGs)(請選擇至多3項與教學內容相關的項目)  Corresponding Sustainable Development Goals (SDGs) (Please choose up to 3 items related to the teaching content) | □SDG1消除貧窮No Poverty  □SDG2消除飢餓Zero Hunger  ■SDG3健康與福祉Good Health and Well-being  □SDG4優質教育Quality Education  □SDG5性別平等Gender Equality  ■SDG6潔淨飲水與衛生Clean Water and Sanitation  □SDG7永續能源Affordable and Clean Energy  □SDG8就業與經濟成長Decent Work and Economic Growth  □ SDG9產業永續創新Industry, Innovation, and Infrastructure  □SDG10減少不平等Reduced Inequality  □ SDG11永續城市與社區Sustainable Cities and Communities  □SDG12永續消費及生產Responsible Consumption and Production  □SDG13氣候行動Climate Action  □SDG14水生生態Life Below Water  □SDG15陸地生態Life on Land  □SDG16和平與正義制度Peace, Justice, and Strong Institutions  □SDG17全球夥伴Partnerships for the Goals |
| 課程類別Course Category | □ STEAM  □人文關懷Humanities and Social Sciences  ■跨域課程Interdisciplinary Courses  ■問題導向Problem-Based Learning  □總整課程Integrated Curriculum  □媒體識讀Media Literacy  □創新課程Innovative Curriculum  □自主學習課程Self-Directed Learning  □無None |
| 課程領域Areas | ■基礎學科(共同)(Basic subjects (common))  ■固態地球科學(Solid earth sciences)  ■水圈科學(Aquatic sciences)  □應用語言(Applied Languages)  ■大氣科學(Atmospheric sciences) |
| 產業領域Areas | □地探科技(Geological monitoring technology)  □氣象科技(meteorological science and technology)  □太空科技(Space Technology)  ■環保科技(environmental protection science and technology)  □資訊科技(Informational Technology)  ■教學研究(Teaching & research)  □地質科技(Geosciences and technology) |

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| 課程進度與內容  Lecture outline and content | | | |
| 週次  week | 日期 Date | 主題  Topic | 授課教師/指定閱讀或作業  Instructor/Readings or assignments |
| **1** | **2/19** | An overview of Isotope Geochemistry in Environmental studies | 黃國芳 Dr. Kuo-Fang Huang |
| **2** | **2/26** | Isotopes as Tracers of Continental and Aquatic Environments-I | 黃國芳 Dr. Kuo-Fang Huang |
| **3** | **3/5** | Isotopes as Tracers of Continental and Aquatic Environments-II | 黃國芳 Dr. Kuo-Fang Huang |
| **4** | **3/12** | Isotopes as tracers of Biogeochemical processes-I | 鍾明宗 Dr. Ming-Tsung Chung |
| **5** | **3/19** | Isotopes as tracers of Biogeochemical processes-II | 鍾明宗 Dr. Ming-Tsung Chung |
| **6** | **3/26** | Isotopes as Tracers of Atmospheric Processes-I | 黃國芳 Dr. Kuo-Fang Huang |
| **7** | **4/2** | Isotopes as Tracers of Atmospheric Processes-II | 黃國芳 Dr. Kuo-Fang Huang |
| **8** | **4/9** | **Mid-term Exam (Written)** | --- |
| **9** | **4/16** | Isotopes as Tracers of Environmental Forensics- I | 黃國芳 Dr. Kuo-Fang Huang |
| **10** | **4/23** | Isotopes as Tracers of Environmental Forensics- II | 黃國芳 Dr. Kuo-Fang Huang |
| **11** | **4/30** | Isotopes as Tracers in Archaeology & Anthropology-I | 黃國芳 Dr. Kuo-Fang Huang |
| **12** | **5/7** | Isotopes as Tracers in Archaeology & Anthropology-II | 黃國芳 Dr. Kuo-Fang Huang |
| **13** | **5/14** | Isotopes as Tracers of Paleoclimate & Paleoenvironments- I | 黃國芳 Dr. Kuo-Fang Huang |
| **14** | **5/21** | Isotopes as Tracers of Paleoclimate & Paleoenvironments- II | 黃國芳 Dr. Kuo-Fang Huang |
| **15** | **5/28** | Isotopes as Tracers of Paleoclimate & Paleoenvironments- III | 黃國芳 Dr. Kuo-Fang Huang |
| **16** | **6/4** | **Final Exam (Oral presentation)** | 黃國芳 Dr. Kuo-Fang Huang |
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| 課程所屬學制(Educational System): 博士班(Doctoral Program) | | | |

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| 核心能力I: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select core abilities and its corresponding assessments of this course |
| 請勾選學程所訂之核心能力(可複選)  ■獨立思考與研究能力Independent thinking and research capacity  ■進階數理及專業知識能力Advanced mathematical and professional knowledge and ability  □觀測模擬及分析推理能力Observation simulation and analysis of reasoning ability  □電腦及程式語言運用能力Computer and programming language proficiency  □國際視野與語文溝通能力International perspective and language communication skills  □專業倫理及服務學習能力Professional ethics and service-learning ability |
| 核心能力II: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select the core abilities and its corresponding assessments of this course |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 強度指數 Overall rating of Core Abilities | 1 非常低 Very Low | 2 低 Low | 3 普通 Medium | 4 高 High | 5 非常高 Very High | 評量方式 Corresponding Assessments | | 獨立思考與研究能力 Independent thinking and research capacity | □ | □ | □ | □ | ■ | ■紙筆測驗/會考(Test/Exam)  ■作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演  (Products/Creative Performance)  □其他(Others) | | 進階數理及專業知識能力 Advanced mathematical and professional knowledge and ability | □ | □ | □ | ■ | □ | ■紙筆測驗/會考(Test/Exam)  ■作業練習(Assignments)  ■口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ■出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 觀測模擬及分析推理能力 Observation simulation and analysis of reasoning ability | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 電腦及程式語言運用能力Computer and programming language proficiency | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 國際視野與語文溝通能力 International perspective and language communication skills | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 專業倫理及服務學習之能力 Professional ethics and service-learning ability | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | |