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| **113(1)/2024 Fall Semester TIGP-ESS課程資訊表**  **113(1)/2024 Fall Semester TIGP-ESS course information form** | |
| 科目名稱(中文) | 科學計算 |
| Course Title (English) | Scientific Programming |
| 授課時間  Time | Mon. 2 – 5 PM |
| 授課地點  Location | IES 511A |
| 學分數  Course Credits | 3 |
| 主要授課老師 Main Instructors | Eh Tan |
| 聯絡郵件  E-mail | [tan2@earth.sinica.edu.tw](mailto:tan2@earth.sinica.edu.tw) |
| 辦公時間 Office Hours | Fri. 10 AM at IES Room 503 |
| 課程目標 Course Objectives | Introduction to scientific programming with Python. |
| 授課內容 Course Description | This course is designed for absolute beginners. No past programming experience is required. The course will be offered in a “flip-classroom” fashion. The students will have to watch online video or read online course material before the class and bring their own laptop computer to the class for in-class exercises. |
| 教科書/參考書 Textbooks/References | Introduction to Scientific Programming with Python, by Joakim Sundnes, Springer, 2020 (https://doi.org/10.1007/978-3-030-50356-7)  Scipy Lecture Note (https://scipy-lectures.org/) |
| 自編教材比例  Self-compiled Textbook/References Proportion(if any) | 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 | 50% Homework, 10% Classroom participation, 20% Midterm, 20% Final |
| 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) 翻譯成英文的話就是：  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** | 9/2 | Python programming environment |  |
| **2** | 9/9 | Basic types and containers |  |
| **3** | 9/16 | Control flow |  |
| **4** | 9/23 | Numpy |  |
| **5** | 9/30 | Matplotlib |  |
| **6** | 10/7 | String and text IO |  |
| **7** | 10/14 | Binary IO |  |
| **8** | 10/21 | Functions |  |
| **9** | 10/28 | Midterm |  |
| **10** | 11/4 | Interpolation |  |
| **11** | 11/11 | Machine Learning |  |
| **12** | 11/18 | Integration |  |
| **13** | 11/25 | Finite difference |  |
| **14** | 12/2 | Symbolic math |  |
| **15** | 12/9 | Debugging and profiling |  |
| **16** | 12/16 | Final |  |
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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) | |