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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 |
| 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 |
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| 強度指數Overall ratingof 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)  |

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