

课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	科学计算与计算机编程 Scientific Computing and Programming
2.	授课院系 Originating Department	地球与空间科学系 Department of Earth and Space Sciences
3.	课程编号 Course Code	ESS202
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业基础课 Major Foundational Courses
6.	授课学期 Semester	春季 Spring
7.	授课语言 Teaching Language	中英双语 English & Chinese
8.	授课教师、所属学系、联系方式 (如属团队授课, 请列明其他授课教师) Instructor(s), Affiliation & Contact (For team teaching, please list all instructors)	张振国, 地球与空间科学系 邮箱: zhangzg@sustech.edu.cn 电话: 0755-88018700 办公室: 创园 9 栋 305 Zhenguo Zhang, Department of Earth and Space Sciences Email: zhangzg@sustech.edu.cn Tel: 0755-88018700 Office: Innovation Park #9-305
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	待公布 To be announced
10.	选课人数限额(可不填) Maximum Enrolment (Optional)	

11. 授课方式 Delivery Method	讲授	习题/辅导/讨论	实验/实习	其它(请具体注明)	总学时
	Lectures	Tutorials	Lab/Practical	Other (Please specify)	Total
学时数 Credit Hours	48				48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	
14. 其它要求修读本课程的学系 Cross-listing Dept.	

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程是地球与空间科学系开设的一门先修课程，主要培养本科生用编程语言解决数值计算问题，为进入相应专业学习研究后更专业的程序计算打下基础，本课程期望达到以下教学目标：

1. 科学计算软、硬件知识；
2. FORTRAN 编程技能；
3. 简单地球物理问题数值算法；
4. 高性能计算基本知识。

This course is one of the preliminary courses when students choose the majors of the department of Earth and Space Sciences. Scientific computing and programming helps the students to get the ability of solving numerical problems by programming languages, enhances the base for further major studies of our department. After the study, the following goals are to be achieved:

1. The software and hardware of scientific computing;
2. Basic skill of FORTRAN language;
3. Simple numerical methods in Geophysical problems;
4. Basic knowledge of high performance computing.

16. 预达学习成果 Learning Outcomes

本课程的最终目的是训练学生利用数值计算手段解决简单地球物理学问题的基本能力，为后期进入专业学习、研究做准备，通过本课程学习，学生预期达到以下学习成果：

1. 了解科学计算软、硬件平台及相关知识；
2. 掌握一种编程语言，能利用该方法分析、解决数值问题；

3. 能用数值方法解决地球物理学中的简单问题;
4. 了解高性能计算最新前沿。

The main purpose of this course is to train the ability of the students to solve the Geophysics problems by numerical methods. The ability of using numerical methods is required and basement of high-level study in Geophysics major. After this course, the students are needed to achieve these goals:

1. Get the knowledges of software and hardware of scientific computing;
2. The students fully understand one of the programming languages, and have the ability to analysis and solve the numerical problems by the programming language;
3. Have the ability to solve Geophysical problems with numerical methods;
4. Know the leading edges of high performance computing, especially in Geophysical fields.

17. 课程内容及教学日历 (如授课语言以英文为主, 则课程内容介绍可以用英文; 如团队教学或模块教学, 教学日历须注明主讲人)
Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

第一章: 科学计算简介 (2 课时)

介绍地球科学中常见的编程语言。

第二章: 计算机硬件和操作系统介绍 (4 课时)

从科学计算的角度理解计算机结构, Windows 和 Linux 操作系统, 程序编写编译基本流程等。

第三章: FORTRAN 基本语法 (12 课时)

介绍 FORTRAN 的数据格式、I/O、数组等。

第四章: FORTRAN 高级语法 (8 课时)

介绍流程控制、循环, 函数与子程序, 文件操作、指针。

第五章: 可视化 (6 课时)

以 MATLAB 为例, 介绍地球物理问题可视化。

第六章: FORTRAN 地球科学问题应用 (10 课时)

利用 FORTRAN 解决地学中的热传导问题, 波动问题, 对流问题。

第七章: 高性能计算 (6 课时)

介绍高性能计算中常见的 MPI, OpenMPI 等。

Chapter 1: Introduction to Scientific Computing (2 hours)

In this section, we will introduce the programming languages in Earth science.

Chapter 2: Introduction to computers hardware and operator system (4 hours)

In this section, we will introduce the computer structure, Operator System of Windows and Linux, basic routes of programming from the viewpoints of scientific computing.

Chapter 3: Basic FORTRAN syntax (12 hours)

Introduction to data format, I/O, array and so on. These are the basics of FORTRAN language.

Chapter 4: Advanced FORTRAN Syntax(8 hours)

Introduction to advanced FORTRAN syntax, such as loop, cycling, subroutine, function, file operation, pointer.

Chapter 5: Visualization (6 hours)

Introduce how to show our geophysical results by visualization. We will focus on Matlab introduction.

Chapter 6: FORTRAN application on Earth science (10 hours)

Introduce how to solve the Geophysical problems, such as heat conduction, wave propagation, and convection, by FORTRAN programming.

Chapter 7: High performance computing (6 hours)

Introduce the skills in the high performance computing, such as the MPI, OpenMPI.

18. 教材及其它参考资料 Textbook and Supplementary Readings

1. Dragos B. Chirila, Gerrit Lohmann, Introduction to Modern Fortran for the Earth System Sciences, Springer, Heidelberg, 2015;
2. Michael Kupferschmid, Classical Fortran: Programming for Engineering and Scientific Applications, Second Edition, CRC Press, Boca Raton, 2009.

课程评估 ASSESSMENT

19. 评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		5		
课堂表现 Class Performance		5		

小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		40		
期中考试 Mid-Term Test				
期末考试 Final Exam		50		
期末报告 Final Presentation				
其它（可根据需要 改写以上评估方 式） Others (The above may be modified as necessary)				

20. 记分方式 GRADING SYSTEM

A. 十三级等级制 Letter Grading
 B. 二级记分制（通过/不通过） Pass/Fail Grading

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority

