

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	重力与固体潮 Gravity and Solid Earth Tide				
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	ESS421				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业选修课 Major Elective 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)	冉将军, 地球与空间科学系 邮箱: ranjj@sustech.edu.cn 电话: 0755-88018644 办公室: 创园 9 栋 3105 Jiangjun Ran, Department of Earth and Space Sciences E-mail: ranjj@sustech.edu.cn Tel: 0755-88018644 Office: Innovation Park #9-3105				
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 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other (Please specify)	总学时 Total
	学时数 Credit Hours	45		3		48
12.	先修课程、其它学习要求	MA101B 高等数学(上) A、MA107A 线性代数 A				

Pre-requisites or Other Academic Requirements	MA101B Calculus I A and MA107A Linear Algebra A
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

本课程的主要学科任务是研究地球形状及外部重力场，主要介绍重力与固体潮的发展过程；位理论基础知识；正常重力场的确定；基于 Stokes 理论和 Molodensky 确定地球形状及外部重力场的基本原理与方法；地球重力场在测绘科学、地球科学及国防与军事科学的应用；固体潮的基本理论等。通过对本课程的理论学习及实践教学，使学生系统全面地掌握重力与固体潮的理论和方法。

This course introduces the theory of the shape and gravity field of the Earth. The main contents include: development history of gravity and the solid tides; basic knowledge of potential; the calculation of normal gravity; the theory and methods to derive the shape and gravity of the Earth based on the Stokes and Molodensky theory; and the theory of solid tide. After studying this course, it helps students understand the theory and technology of gravity and solid tide comprehensively and systematically.

16. 预达学习成果 Learning Outcomes

学生完成本课程后，将会掌握以下知识：

1. 位理论和固体潮基础知识；
2. 正常重力场的确定；
3. 解算大地水准面形状的 Stokes 理论；
4. Molodensky 理论确定地球形状的基本原理；
5. 地球重力场在测绘科学、地球科学及国防与军事科学的应用等。

Upon completing the course, students will master the following knowledge:

1. The basic theory of potential;
2. The definition of normal gravity;
3. The theory, method and applications of calculating the Earth's shape using Stokes theory;
4. The theory and algorithms of calculating the Earth's gravity field using the Molodensky theory;
5. The application of gravity in the field of Geosciences and military.

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 概述（2学时）

讲授重力与固体潮课程的任务及学科内容，该课程与本专业其它课程、地球物理、地球动力学等相关学科的关系，以及应用。

第二章 重力测量原理（5学时）

重力的定义及重力测量的概念、动力法测定绝对重力、静力法测定相对重力、重力测量仪器简介、重力基准

第三章 位理论基础（10学时）

引力及引力位、谐函数，拉普拉斯方程，球谐函数和边值问题。

第四章 正常重力场（8学时）

正常重力场的概念、地球重力位的球函数展开式、确定正常重力场的 Laplace 方法和 Stokes 方法

第五章 确定大地水准面形状的 Stokes 理论（10学时）

大地水准面的定义及性质、扰动位的作用及重力测量基本微分方程、大地水准面上扰动位的求解、大地水准面高、垂线偏差、重力归算及重力异常

第六章 Molodensky 理论确定地球形状的基本原理和重力测量实验（5学时。包括3学时实验课）

高程系统、地面重力异常、高程异常与似大地水准面、Molodensky 边值问题及其解、相对重力测量实验

第七章 地球重力场的应用（5学时）

地球重力场与测绘科学、地球重力场与相关地球科学、地球重力场与军事科学

第八章 地球固体潮 (3 学时)

地球固体潮的基本理论和计算方法。

Chapter 1: Introduction (2 hours)

Introduce the basic concepts, development, research contents and applications of gravity and solid tide. The relation of this course and other courses about Geophysics, Geodynamics, etc.

Chapter 2: the theory of gravimetry (5 hours)

The definition of gravity and gravimetry, different methods to measure absolute and relative gravity, the introduction of instruments to measure gravity.

Chapter 3: the potential theory (10 hours)

The gravitational force and Potential of a solid body, Harmonic functions, Laplace's equation in spherical coordinates, Spherical harmonics, boundary-value problems

Chapter 4: Normal gravity (8 hours)

The definition of normal gravity, the potential of the earth in terms of spherical harmonics, the Laplace and Stokes methods to derive normal gravity

Chapter 5: the theory to calculate the Earth's shape using Stokes theory (10 hours)

The definition of Geoid, the disturb potential, the basic partial equation of gravimetry, the solution of disturb potential, gravimetric deflection of the vertical, gravity reduction and gravity anomaly.

Chapter 6: the theory to calculate the Earth's shape using Molodensky theory and gravity measurement experiment (5 hours, Including 3 lab credits)

Height system, gravity anomaly and quasi-geoid, boundary problems of Molodensky and the solution, experiment of relative gravimetry

Chapter 7: application of gravity field (5 hours)

The application of gravity in Surveying and Mapping, Geoscience and military.

Chapter 8: solid Earth tide (3 hours)

The basic theory of solid Earth tide and calculation.

Southern University
of Science and
Technology

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

1. Hofmann-Wellenhof, Bernhard, Moritz, Helmut, Physical Geodesy, springer, 1967
2. Hofmann-Wellenhof, Bernhard, Moritz, Helmut, Physical Geodesy (second), springer, 2006
3. 海斯卡涅 W. A., 莫里斯 H. (卢福康, 胡国理译). 物理大地测量学. 北京: 测绘出版社, 1979
4. 阿诺尔德 K. (武汉测绘学院《卫星大地测量方法》翻译组译). 卫星大地测量方法. 北京: 测绘出版社, 1980
5. 孔祥元, 郭际明, 刘宗泉, 大地测量学基础, 武汉大学出版社, 2006.

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		10		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		20		
期中考试 Mid-Term Test		30		

期末考试 Final Exam	40		
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

地球与空间科学系本科教学指导委员会

