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**	连续介质力学 Continuum Mechanics
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**	ESS213
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）**	杨亭，地球与空间科学系 邮箱：yangt3@sustech.edu.cn 电话：0755-88018637 办公室：理学院 E4132 Ting Yang, Department of Earth and Space Sciences Email: yangt3@sustech.edu.cn Tel: 0755-88018637 Office: College of Science, #E-4132
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	48				48

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	高等数学（上）、线性代数 Calculus I and Linear Algebra
13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	无 NA
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

本课程为地球物理学和空间物理学本科生专业基础课。本课程主要讲述连续介质力学的基本理论，为后续专业课程（例如地震学、地球物理反演、地球动力学、地震勘探和岩石力学、空间物理等）的学习准备必要的理论知识。

This is a major foundational course for undergraduate students in Geophysics and Space Physics. This course aims to teach the fundamental theory of continuum mechanics and prepare students for study of the major core courses of ESS.

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. 理解应力应变的物理含义，能够计算主应力和应力张量不变量；
2. 理解弹性参数的物理含义，能够利用胡克定律进行简单的应力应变分析；
3. 了解定义一个完整的弹性静力学问题所需的方程和边界条件，以及这类问题的一般求解方法；
4. 了解张量和并矢的基本概念
5. 理解随流导数、流线、压强、粘滞应力、本构方程等流体力学的基本概念
6. 掌握流体力学的基本控制方程。

Upon completing the course, students will:

1. Understand the physical meaning of stress and strain and can calculate principal stresses and stress invariants;
2. Understand the physical meaning of elastic moduli and can perform some basic stress-strain analysis based on Hooke's law;
3. Know how to write down the system of equations for a static equilibrium problem and the general methods for solving it;
4. Know the basic concepts of tensor and dyadic.
5. Understand the basic concepts of fluid mechanics, such as substantial derivative, streamline, pressure, viscous stress, and constitutive equation
6. Master how to derive the governing equations in fluid mechanics.

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 绪论（1 学时）
本章为连续介质力学的理论基础和应用介绍。

第二章 应力分析（5 学时）
本章介绍应力定义、主应力计算、应力不变量、应力莫尔圆和静力平衡方程。

第三章 应变分析（4 学时）
本章介绍应变定义、正应变、剪应变和应变协调方程。

第四章 应力应变关系（6 学时）
本章介绍广义胡克定律和不同弹性参数的定义和物理意义。

第五章 弹性力学定解问题（8 学时）
本章介绍 3D 空间及 2D 平面应力和平面应变条件下弹性静力学问题的控制方程组和一般的求解方法。

第六章 张量分析（10 学时）
本章介绍并矢和张量的定义，以及张量运算的规则和技巧。

第七章 流体力学基本概念（4 学时）
本章介绍流体、随流导数、应变率、流线、压强、粘滞应力等流体力学基本概念

第八章 流体力学控制方程（6 学时）
本章介绍粘性的本构方程和基本控制方程组。

第九章 流体力学基本方程的应用（4 学时）
本章利用流体力学基本原理解决一些重要的地球学科问题。

Chapter 1 Introduction (1 hours)
This section gives an overview of the theory and applications of continuum mechanics.

Chapter 2 Stress Analysis (5 hours)
This section introduces the Euler-Cauchy stress principle, calculation of principal stresses, stress invariants, Mohr's Circle, and static equilibrium equations.

Chapter 3 Strain Analysis (4 hours)
This section introduces the strain definition, meaning of normal strain and shear strain, and strain compatibility equations.

Chapter 4 Stress-strain relations (6 hours)
This section introduces the generalized Hooke's law and the definition of different elastic constants.

Chapter 5 Formulation of problems in elasticity (8 hours)
This section discusses the general formalism of a static equilibrium problem and the procedures for deriving a static solution in 3D space and 2D plain stress or plain strain spaces.

Chapter 6 Tensor Analysis (10 hours)
This section introduces the definition of dyadic, the principles of tensor algebra and the mathematical skills used in tensor analysis.

Chapter 7 Basic concepts of Fluid mechanics (4 hours)
This section introduces fluid, substantial derivative, strain rate, and other basic concepts in fluid mechanics.

Chapter 8 Fluid mechanics (6 hours)
This section introduces the constitutive equation and governing equations in fluid mechanics

Chapter 9 Applications of fluid mechanics to geoscience (4 hours)
This section uses fluid mechanics to solve some important questions in geoscience.

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

1. Elasticity - Tensor, Dyadic & Engineering Approaches: Pei Chi Chou and Nicholas J. Pagano, Dover Publications Inc., 1992.
2. Incompressible Flow: Ronald Panton, 4th Ed, 2013
3. Continuum Mechanics: Spencer, 2004.

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		35		
期中考试 Mid-Term Test		15		
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

地球与空间科学系科教学指导委员
Undergraduate Teaching Steering Committee of Department of Earth and Space Sciences