课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	**ESS5031/地球与行星内部物理学 Physics of Earth and Planetary Interiors**
2.	**课程性质** **Compulsory/Elective**	选修课/Elective
3.	**课程学分/学时** **Course Credit/Hours**	3/48
4.	**授课语言** **Teaching Language**	中文/Chinese
5.	**授课教师** **Instructor(s)**	景志成/Zhicheng Jing
6.	**先修要求** **Pre-requisites**	本课程针对理工科研究生开设，需要具备微积分、普通物理等数理基础。 The course is designed for graduate students in Science and Engineering. Calculus and General Physics are pre-requisites for this course.
7.	**教学目标** **Course Objectives**	
	学生完成本课程后，将会： （1）掌握关于矿物物理学的基本原理和方法； （2）具有应用矿物物理的结果理解地球和其它行星内部结构、组成、动力学和演化的能力； （3）通过进行学期项目和口头报告学习怎样开展地球与行星内部物理学的科学研究。 Upon completion of the course, students will: (1) master the basic principles and methods in mineral physics (2) be able to apply the results in mineral physics to understanding the internal structure, composition, dynamics, and evolution of Earth and other planetary bodies; (3) learn how to conduct research in the areas of Earth and planetary interiors by conducting a term research project and give an oral presentation.	
8.	**教学方法** **Teaching Methods**	
	本课程将以课堂讲授为主，辅以作业、课程项目和期末报告。 The course will compose lectures, complemented with homework, course project, and final presentation.	
9.	**教学内容** **Course Contents**	
	Section 1	Introduction to the course (2 hours) Introduction to the course contents, goals, and assessment
	Section 2	Chemical composition of Earth and planets (2 hours) Formation of elements; chemical composition of the solar system; condensation of the solar nebula; chemical differentiation of planets
	Section 3	Mass, density, gravity, and pressure in planetary interiors (4 hours) Mass, radius, and moment of inertia of planetary bodies; gravity and pressure; mass distribution in planets
	Section 4	Thermodynamics of planetary materials (I) (4 hours) Review of thermodynamics for one-component systems;

		thermodynamic properties and thermodynamic relations
	Section 5	Compression of planetary materials and equation of state (6 hours) Equation of state of gases; density of materials under planetary interior conditions; high-pressure experimental methods
	Section 6	Crystal structure and crystal chemistry (4 hours) Crystal structure and X-ray diffraction; crystal chemistry in planetary interiors; chemical bonding and interatomic potentials
	Section 7	Thermodynamics of planetary materials (II) (4 hours) Review of thermodynamics for multiple component systems; chemical reactions; law of mass action; activity and fugacity; phase diagrams
	Section 8	Structure and mineralogy of Earth and planets (4 hours) Phase transition and phase equilibria; structure and mineralogy of Earth and planets
	Section 9	Elasticity and seismic wave velocity of planetary materials (4 hours) Elasticity of planetary materials; Birch's law; seismic anisotropy
	Section 10	Thermal properties of Earth and planetary materials (6 hours) Lattice vibrations; thermal properties; temperature profiles in planets; effect of temperature on seismic velocities; melting, element partitioning, and chemical differentiation
	Section 11	Transport properties and dynamics of Earth and planetary interiors (6 hours) Crystalline defects and diffusion; rheology of mantle and core materials; electrical and thermal conductivities;
	Section 12	Term project presentations (2 hours) Oral presentations for term projects
10.	**课程考核** **Course Assessment**	
	请在此注明：①考查/考试；②分数构成。 出勤 5%+课堂表现 5%+作业 50%+课程项目 20%+期末报告 20% Attendance 5%, class performance 5%, homework 50%, course project 20%, final paper and presentation 20%	
11.	**教材及其它参考资料** **Textbook and Supplementary Readings**	
	Poirier, J.-P., 2000, Introduction to the Physics of the Earth's Interior, Cambridge University Press. Stacey, F. and Davis, P., 2008, Physics of the Earth, Cambridge University Press. Karato, S., 2008, Deformation of Earth Materials, Cambridge University Press.	