

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	ESS5027 力电耦合原理 Principal of Mechanical-Electromagnetic Coupling
2.	课程性质 Compulsory/Elective	专业选修课 (specialized elective course)
3.	课程学分/学时 Course Credit/Hours	2/32
4.	授课语言 Teaching Language	中英 (Chinese & English)
5.	授课教师 Instructor(s)	任恒鑫 (Ren, Hengxin)
6.	先修要求 Pre-requisites	无
7.	教学目标 Course Objectives	
	<p>通过本课程的学习，使得学生了解产生力电耦合现象的几种主要机制，包括动电效应、压电效应、压磁效应以及感应电磁效应，明白这几种不同的力电耦合机制的基本原理，了解力电耦合在地震电磁学研究中所起的重要作用。</p> <p>Upon completing the course, students will obtain the basic knowledge on the fundamentals of several mechanisms (including electrokinetic effect, piezoelectric effect, piezomagnetic effect, and motional induction effect), which are responsible for the coupling between mechanical and electromagnetic wave-fields. Students also will understand the important role of the mechanical-electromagnetic coupling in the study of earthquake-related electromagnetic phenomena.</p>	
8.	教学方法 Teaching Methods	
	<p>本课采用课堂讲授、文献研读以及课堂讨论相结合的方式。</p> <p>The teaching methods include lecturing, literature study and class discussion.</p>	
9.	教学内容 Course Contents	
	Section 1	<p>力电耦合概述 (Overview of the mechanical-electromagnetic coupling) week: 1 内容: 力电耦合现象, 野外观测、实验研究、和理论研究现状</p> <p>This section will give an overview of the observational, experimental, and theoretical studies on the mechanical-electrical coupling phenomena.</p>
	Section 2	<p>力电耦合机理 (mechanical-electromagnetic coupling mechanisms) week: 2-4 内容: 孔隙介质动电效应、感应电磁效应、压电效应和压磁效应的基本原理</p> <p>This section will introduce fundamentals of the electrokinetic effect, the motional induction effect, the piezoelectric effect and piezomagnetic effect.</p>
	Section 3	<p>力电耦合波场的数值模拟 (Numerical simulation of the mechanical-electromagnetic coupling wave-fields) week: 5-8 内容: 介绍如何利用数值方法模拟相互耦合的地震波和电磁场</p> <p>This section will introduce the numerical simulation of the seismic and electromagnetic wave-fields caused by the mechanical-electromagnetic coupling.</p>
	Section 4	<p>地震电磁异常现象 (Seismo-electromagnetic anomalous phenomena) week: 9-11 内容: 地震相关的电磁异常现象及其可能的理论解释</p>

	This section will introduce the earthquake-related electromagnetic anomalous phenomena and their possible theoretical interpretations.
Section 5	地震电磁前兆 (Seismo-electromagnetic precursor) week: 12 内容: 结合几个实际震例介绍地震电磁前兆 This section will utilize several actual earthquakes to introduce seismo-electromagnetic precursor.
Section 6	文献研读 (Literature study) week: 13-16 内容: 相关文献调研, 在课堂上做文献研读报告, 师生在课堂上共同讨论 This section covers investigation on related literatures, class report of the literature study, and class discussion.
10.	课程考核 Course Assessment
	课程最终成绩根据出勤率、平时作业和课堂表现综合评定 (出勤率 10%+平时作业 50%+课堂表现 40%)。 Assessment will be based on attendance rate (10%), regular assignment (50%) and classroom performance (40%).
11.	教材及其它参考资料 Textbook and Supplementary Readings
	<ol style="list-style-type: none"> 1) Pride, S.R., 1994. Governing equations for the coupled electromagnetics and acoustics of porous media, <i>Phys. Rev. B</i>, 50, 15 678–15 696. 2) Pride, S.R. & Haartsen, M.W., 1996. Electro seismic wave properties, <i>J. acoust. Soc. Am.</i>, 100, 1301–1315. 3) Jouniaux, L. & Ishido, T., 2012. Electrokinetics in earth sciences: a tutorial, <i>Int. J. Geophys.</i>, 2012, 286107, doi:10.1155/2012/286107. 4) Yamazaki, K., 2012, Estimation of temporal variations in the magnetic field arising from the motional induction that accompanies seismic waves at a large distance from the epicentre, <i>Geophys. J. Int.</i>, 190, 1393-1403. 5) 丁鉴海等, 2011, 地震地磁学概论, 中国科学技术大学出版社 6) 高长银, 2012, 压电效应新技术及应用, 电子工业出版社 7) 徐世浙, 1979, 关于压磁效应和膨胀磁效应, 地震学报