

## 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 <b>Course Title</b>	电动力学 I Electrodynamics I
2.	授课院系 <b>Originating Department</b>	物理系 Department of physics
3.	课程编号 <b>Course Code</b>	PHY207
4.	课程学分 <b>Credit Value</b>	3
5.	课程类别 <b>Course Type</b>	专业基础课 Major Foundational Courses
6.	授课学期 <b>Semester</b>	秋季/春季 Fall/Spring
7.	授课语言 <b>Teaching Language</b>	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) <b>Instructor(s), Affiliation &amp; Contact</b> (For team teaching, please list all instructors)	秋季: 黄明远, 副教授, 物理系 第二科研楼 113 室 HUANG Mingyuan, Associate Professor, Department of Physics Rm.113, No.2 Research Bldg. <a href="mailto:huangmy@sustech.edu.cn">huangmy@sustech.edu.cn</a> 0755-88010343  春季: 叶飞, 教学教授, 物理系 第二科研楼 228 室 yef@sustech.edu.cn Fei Ye, Teaching Professor, Department of Physics Rm.228, No.2 Research Bldg. <a href="mailto:yef@sustech.edu.cn">yef@sustech.edu.cn</a>
9.	实验员/助教、所属学系、联系方式 <b>Tutor/TA(s), Contact</b>	待公布 To be announced
10.	选课人数限额(可不填) <b>Maximum Enrolment</b>	

(Optional)

11. 授课方式  
Delivery Method
- 学时数  
Credit Hours

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
42	6			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.

同修: 数学物理方法 (PHY203-15) Co-requisites: Mathematical Methods in Physics (PHY203-15)
电动力学 II Electrodynamics II

### 教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程主要讲授静电学、静磁学的相关知识。内容包括：电动力学的基本定律，几种求解静电、静磁学边界问题的特殊方法，以及物质与电磁场的相互作用。此外，还会介绍麦克斯韦方程组的基本理论。

This course is to teach the theory of electrostatics and magnetostatics, which will include the fundamental laws of electrodynamics, special techniques to solve the boundary problems in electrostatics and magnetostatics and the interaction between the matter and electrostatic and magnetic field. Further, the basic theory will be extended to Maxwell's equation.

16. 预达学习成果 Learning Outcomes

完成本课程学习的同学应具备以下能力：

- 理解电磁学的基本理论，理解物质与电磁场的相互关系
- 能够依据电磁学的基本理论直接解决静电、静磁场中的相关问题
- 能够运用数学工具解决静电、静磁场的边界问题

On completion of the course the student shall be able to:

- Understand basic principles of electromagnetism and the interaction between matter and electric and magnetic field.
- Solve the electrostatic and magnetostatic field directly from the fundamental theory.
- Solve the boundary problems in electrostatics and magnetostatics by using mathematical tools.

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：矢量分析（第 1-2 周）

标量与向量的微积分；爱因斯坦求和约定与张量的定义；球坐标与柱坐标下的微分运算；狄拉克  $\delta$  函数。

第二章：静电场（第 3-4 周）

点电荷与连续电荷的库仑定律；静电场的散度与旋度；电势；静电场的能量；导体的基本性质。

第三章：特殊技术（第 5-7 周）

唯一性定理和边界条件；镜像法和格林函数法解泊松方程；分离变量法解拉普拉斯方程；多级展开

第四章：物质中的电场（第 8-9 周）

电介质的极化；极化物体的电场；电位移矢量；线性电介质

第五章：静磁学（第 10-11 周）

洛伦兹力定律；毕奥-萨瓦尔定律和磁场；磁场的散度和旋度；磁矢势

第六章：物质中的磁场（第 12-13 周）

物质的磁性；磁化物体的磁场；辅助场和磁介质中的安培定理；线性与非线性介质

第七章：电动力学（第 14-16 周）

电动势；电磁感应和法拉第定律；磁场的能量；真空和介质中的麦克斯韦方程组；边界条件

Chapter 1. Vector Analysis (week 1-2)

Differential and integral calculus for scalar and vector field; Index notation and definition of tensor; Differential operator in spherical and cylindrical coordinates; Dirac delta function.

Chapter 2. Electrostatic field (week 3-4)

Coulomb's law and electric field from point charge to continuous charge distribution; Divergence and curl of electrostatic field; electric potential; Energy in electrostatics; Basic properties of conductors.

Chapter 3. Special techniques (week 5-7)

Uniqueness theorem and boundary conditions; The method of images and Green function for Poisson's equation; Separation variable method for Laplace's equation; Multipole expansion.

Chapter 4. Electric field in matter (week 8-9)

Polarization of dielectrics; electric field of polarized object; electric displacement; Linear dielectrics.

Chapter 5. Magnetostatics (week 10-11)

Lorentz force law; Biot-Savart law and magnetic field; Divergence and Curl of magnetic field; Magnetic vector potential.

Chapter 6. Magnetic field in matter (week 12-13)

Magnetization of matter; Magnetic field of magnetized object; Auxiliary field and Ampere's law in magnetized materials; Linear and nonlinear media.

Chapter 7. Electrodynamics (week 14-16)

Electromotive force; electromagnetic induction and Faraday's law; Energy in magnetic field; Maxwell's equations in vacuum and matter; boundary conditions.

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

**Textbook**

David J. Griffiths, Introduction to electrodynamics, third Ed., 1999

**References**

(1) J.D. Jackson, Classical Electrodynamics, 1975年;

(2) 刘觉平著, 《电动力学》, 武汉大学出版社, 1997年

(3) 俞允强著, 《电动力学简明教程》, 北京大学出版社, 1999年;

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				
课堂表现 Class Performance				
小测验 Quiz		20%		

课程项目 <b>Projects</b>			
平时作业 <b>Assignments</b>	10%		
期中考试 <b>Mid-Term Test</b>			
期末考试 <b>Final Exam</b>	70%		
期末报告 <b>Final Presentation</b>			
其它（可根据需要 改写以上评估方 式） <b>Others (The above may be modified as necessary)</b>	可根据需要改写以上 评估方式  <b>The above may be modified as necessary</b>		

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**

物理系教学指导委员会  
 Education Instruction Committee of Physics department

