

## 课程教学大纲

| 课程基本信息 (Course Information)       |  |                           |                                   |                 |   |
|-----------------------------------|--|---------------------------|-----------------------------------|-----------------|---|
| 课程代码<br>(Course Code)             | PH239  | 学时<br>(Credit Hours)      | 64                                | 学分<br>(Credits) | 4 |
| 课程名称<br>(Course Name)             | (中文) 数学物理方法 (2)  |                           |                                   |                 |   |
|                                   | (英文) Mathematical Physics (2)  |                           |                                   |                 |   |
| 课程性质<br>(Course Type)             | 培养计划课程<br>Required Course  |                           |                                   |                 |   |
| 授课语言<br>(Language of Instruction) | 英文<br>English  |                           |                                   |                 |   |
| 开课院系<br>(School)                  | 物理与天文系<br>Department of Physics and Astronomy  |                           |                                   |                 |   |
| 先修课程<br>(Prerequisite)            | 高等数学 (1), 高等数学 (2), 物理学引论 (1), 物理学引论 (2)<br>Calculus I, Calculus II, Introduction to Physics I, Introduction to Physics II   |                           |                                   |                 |   |
| 授课教师<br>(Teacher)                 | 罗卫东<br>Weidong Luo   | 电邮、电话<br>(email& phone)   | wdluo@sjtu.edu.cn                 |                 |   |
| 办公时间<br>(Office Time)             | 周一下午 1:00-3:00,<br>周三下午 1:00-3:00  | 办公地点<br>(Office Location) | 自然科学研究院 (包图 524)<br>INS, Room 524 |                 |   |
| 课程网址<br>(Course Webpage)          |  |                           |                                   |                 |   |
| *课程简介<br>(Description)            | “数学物理方法 (2)” 是上海交通大学致远学院物理班的核心课程。本课程涉及数个主题, 包括复变函数及其应用、积分变换、变分法、共形映射及其应用、概率论和数理统计。主要目标是让学生掌握物理专业必要的数学方法。在学习本课程之后, 学生应该具有牢固的数学基础和运用数学方法解决问题的技能, 为后续的物理课程打好基础。   |                           |                                   |                 |   |
| *课程简介<br>(Description)            | Mathematical Physics (2) is a core course required for undergraduate students in the Physics Class of Zhiyuan College at Shanghai Jiao Tong University. The course covers several topics, including complex functions and applications, integral transforms, calculus of variations, conformal mapping and its applications, probability theory and statistical methods. The primary objective is to develop those parts of the mathematical methods that are essential to students majored in physics. After taking this mathematical physics course, students will have a solid foundation of mathematics and problem-solving skills, which form a solid foundation for the up-coming physics courses. |                           |                                   |                 |   |
| 课程教学大纲 (course syllabus)          |  |                           |                                   |                 |   |

| <p>*学习目标<br/>(Learning Outcomes)</p>                         | <p>通过本课程的学习，学生应该能够：</p> <ol style="list-style-type: none"> <li>1. 理解掌握解析函数的相关理论；</li> <li>2. 运用留数理论计算各种积分；</li> <li>3. 使用傅立叶变换和拉普拉斯变换解决相关物理问题；</li> <li>4. 熟悉变分法；</li> <li>5. 运用共形映射方法解决有关物理问题；</li> <li>6. 熟悉物理问题中常见的几种概率分布及统计方法。</li> </ol> <p>After completing the course, students should be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the theory of analytic functions;</li> <li>2. Apply the theory of residues to evaluate various integrals;</li> <li>3. Use Fourier transform and Laplace transform to solve physics problem;</li> <li>4. Be familiar with the calculus of variations;</li> <li>5. Apply the method of conformal mapping to solve related physics problems;</li> <li>6. Be familiar with the common probability distributions and statistical methods in physics.</li> </ol>   |         |       |      |          |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
|--|---|---------|-------|------|----------|--|------|----|------|-------|------|------|---------|---|----|--|--|----|------|---|----|--|--|----|----|---|----|--|--|----|----|---|----|--|--|----|-------|---|----|--|--|----|-------|---|----|--|--|----|-------|---|----|--|--|----|--------|---|----|--|--|----|-----|---|----|--|--|----|------|---|----|--|--|----|---------|---|----|--|--|----|-------|----|----|--|--|----|--|---|---------|--|--|----------|----------------------|---|---------|--|--|----------|-----------|---|---------|--|--|----------|--------|---|---------|--|--|----------|--------------------|---|---------|--|--|----------|
| <p>*教学内容、进度安排及要求<br/>(Class Schedule &amp; Requirements)</p> | <table border="1"> <thead> <tr> <th>教学内容</th> <th>学时</th> <th>教学方式</th> <th>作业及要求</th> <th>基本要求</th> <th>考查方式</th> </tr> </thead> <tbody> <tr> <td>复数和解析函数</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>初等函数</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>积分</td> <td>6</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>级数</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>留数和极点</td> <td>6</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>留数的应用</td> <td>6</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>傅立叶变换</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>拉普拉斯变换</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>变分法</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>共形映射</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>共形映射的应用</td> <td>4</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>概率与统计</td> <td>12</td> <td>讲课</td> <td></td> <td></td> <td>作业</td> </tr> <tr> <td>Complex numbers and analytic functions</td> <td>4</td> <td>lecture</td> <td></td> <td></td> <td>homework</td> </tr> <tr> <td>Elementary functions</td> <td>4</td> <td>lecture</td> <td></td> <td></td> <td>homework</td> </tr> <tr> <td>Integrals</td> <td>6</td> <td>lecture</td> <td></td> <td></td> <td>homework</td> </tr> <tr> <td>Series</td> <td>4</td> <td>lecture</td> <td></td> <td></td> <td>homework</td> </tr> <tr> <td>Residues and poles</td> <td>6</td> <td>lecture</td> <td></td> <td></td> <td>homework</td> </tr> </tbody> </table> |         |       |      |          |  | 教学内容 | 学时 | 教学方式 | 作业及要求 | 基本要求 | 考查方式 | 复数和解析函数 | 4 | 讲课 |  |  | 作业 | 初等函数 | 4 | 讲课 |  |  | 作业 | 积分 | 6 | 讲课 |  |  | 作业 | 级数 | 4 | 讲课 |  |  | 作业 | 留数和极点 | 6 | 讲课 |  |  | 作业 | 留数的应用 | 6 | 讲课 |  |  | 作业 | 傅立叶变换 | 4 | 讲课 |  |  | 作业 | 拉普拉斯变换 | 4 | 讲课 |  |  | 作业 | 变分法 | 4 | 讲课 |  |  | 作业 | 共形映射 | 4 | 讲课 |  |  | 作业 | 共形映射的应用 | 4 | 讲课 |  |  | 作业 | 概率与统计 | 12 | 讲课 |  |  | 作业 | Complex numbers and analytic functions | 4 | lecture |  |  | homework | Elementary functions | 4 | lecture |  |  | homework | Integrals | 6 | lecture |  |  | homework | Series | 4 | lecture |  |  | homework | Residues and poles | 6 | lecture |  |  | homework |
| 教学内容   | 学时  | 教学方式    | 作业及要求 | 基本要求 | 考查方式     |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 复数和解析函数  | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 初等函数   | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 积分   | 6   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 级数   | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 留数和极点  | 6   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 留数的应用  | 6   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 傅立叶变换  | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 拉普拉斯变换   | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 变分法  | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 共形映射   | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 共形映射的应用  | 4   | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| 概率与统计  | 12  | 讲课      |       |      | 作业       |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| Complex numbers and analytic functions                       | 4   | lecture |       |      | homework |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| Elementary functions   | 4   | lecture |       |      | homework |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| Integrals  | 6   | lecture |       |      | homework |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| Series   | 4   | lecture |       |      | homework |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |
| Residues and poles   | 6   | lecture |       |      | homework |  |      |    |      |       |      |      |         |   |    |  |  |    |      |   |    |  |  |    |    |   |    |  |  |    |    |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |       |   |    |  |  |    |        |   |    |  |  |    |     |   |    |  |  |    |      |   |    |  |  |    |         |   |    |  |  |    |       |    |    |  |  |    |  |   |         |  |  |          |                      |   |         |  |  |          |           |   |         |  |  |          |        |   |         |  |  |          |                    |   |         |  |  |          |

|   |  |    |         |  |  |          |
|---|--|----|---------|--|--|----------|
|   | Applications of residues   | 6  | lecture |  |  | homework |
|   | Fourier transform  | 4  | lecture |  |  | homework |
|   | Laplace transform  | 4  | lecture |  |  | homework |
|   | Calculus of variations   | 4  | lecture |  |  | homework |
|   | Conformal mapping  | 4  | lecture |  |  | homework |
|   | Applications of conformal mapping  | 4  | lecture |  |  | homework |
|   | Probability and statistics   | 12 | lecture |  |  | homework |
| *考核方式<br>(Grading)                        | 最终成绩由三部分组成，即平时成绩（40%）、两次平时考试（20%）、期末考试（40%）。<br>The final grade will be determined based on class attendance and regular homework (40%), two one-hour exams during the semester (20%), and the final exam (40%). |    |         |  |  |          |
| *教材或参考资料<br>(Textbooks & Other Materials) | <i>Complex Variables and Applications</i> , by J. W. Brown & R. V. Churchill.  |    |         |  |  |          |
| 其它<br>(More)                              |  |    |         |  |  |          |
| 备注<br>(Notes)                             |  |    |         |  |  |          |

备注说明：

1. 多于 1 位教师授课的课程，如公共课程、基础课程等经教学团队商议后由负责人填写。
2. 带\*为必填项目，其他栏目根据课程情况选填。
3. 课程简介字数为 300-500 字；课程大纲以表述清楚教学安排为宜，字数不限。