等离子体物理课程教学大纲

<table>
<tr><td colspan="6">课程基本信息（Course Information）</td></tr>
<tr><td>课程代码
（Course Code）</td><td>PH339</td><td>*学时
（Credit Hours）</td><td>3</td><td>*学分
（Credits）</td><td>48</td></tr>
<tr><td rowspan="2">*课程名称
（Course Name）</td><td colspan="5">等离子体物理</td></tr>
<tr><td colspan="5">Plasma Physics</td></tr>
<tr><td>课程性质
(Course Type)</td><td colspan="5">物理学专业、物理学专业（国际班）选修课</td></tr>
<tr><td>授课对象
（Audience）</td><td colspan="5">物理学专业、物理学专业（国际班）大学三年级本科生</td></tr>
<tr><td>授课语言
(Language of Instruction)</td><td colspan="5">英文</td></tr>
<tr><td>*开课院系
（School）</td><td colspan="5">物理与天文学院</td></tr>
<tr><td>先修课程
（Prerequisite）</td><td colspan="5">Classical electrodynamics</td></tr>
<tr><td>授课教师
（Instructor）</td><td colspan="2"></td><td>课程网址
(Course Webpage)</td><td colspan="2"></td></tr>
<tr><td>*课程简介（Description）</td><td colspan="5">The course is introductory-level plasma physics where I teach students the fundamental concepts, theories and some potential applications for plasma physics. Fundamental theories include single-particle approach as a first step which gives a reasonable background on different particle drift motions in various E- and B-field configurations some are relevant to E-B fields of magnetic-confinement machines like EAST Tokamak in CHINA. The fluid-theory of plasma physics is given and directly applied to various (tens) kinds of plasma waves (EM and ES) and their propagation characteristics in plasma. A modified approach of the fluid theory, called “MHD” is applied to get the electrical properties and the stability properties of the plasma in various confinement configurations, including the most famous 2D equilibrium configuration called “Grad-Shafranov”. Finally I teach the basics of the microscopic theory of plasma physics which is the kinetic approach. Based on this theory I derive the exact dispersion relationship of plasma waves and the so called “Landau damping”. Throughout the course, we teach how the plasma physics is applied, for example to create a nuclear fusion reactor for future energy needs etc.</td></tr>
<tr><td colspan="6">课程教学大纲（Course Syllabus）</td></tr>
</table>

<table>
<tr><td>*学习目标(Learning Outcomes)</td><td>After completing the course, students should know:
1． Plasma in nature and how to create it on earth and laboratory
2． Single-particle motions and drifts in variety of E- and B- field configurations
3． Macroscopic “Fluid” theory of plasma physics and the plasma approximation
4. Plasma waves and their propagation (Plasma Optics)
5. The Plasma Diffusion problem and Resistivity
6. Magnetohydrodynamics and the Equilibrium configurations of plasmas
7. Microscopic theory of plasma physics (Kinetic approach) and Landau damping</td></tr>
<tr><td>*教学内容、进度安排及要求(Class Schedule & Requirements)</td><td>
<table>
<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>
<tr><td>Introduction and basic parameters of plasma media</td><td>4</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Single particle motion in various E－B fields</td><td>6</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Fluid formulation of plasma physics</td><td>6</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Plasma Waves</td><td>8</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Advanced Plasma Waves</td><td>4</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Plasma Diffusion</td><td>4</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Electrical properties of Plasma</td><td>4</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>MHD and Equilibrium</td><td>6</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知识，并能灵活运用</td><td>作业+随堂小测</td></tr>
<tr><td>Kinetic Theory of plasmas</td><td>4</td><td>课堂，PPT+板书</td><td>根据进度，随堂布置</td><td>掌握相关基本知</td><td>作业+随堂小测</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td><table>
<tr><td>and Landau damping</td><td></td><td></td><td></td><td>识，并能灵活运用</td><td></td></tr>
<tr><td>Final Exams</td><td>2</td><td></td><td></td><td></td><td></td></tr>
</table></td></tr>
<tr><td>*考核方式(Grading)</td><td>assess students based on the following
1. Activity in class
2. Assignments and homework
3. Attendance
4. Midterm-exam results
5. Final exam results</td></tr>
<tr><td>*教材或参考资料 (Textbooks & Other Materials)</td><td>F.F. Chen ”Introduction to Plasma Physics and Controlled Fusion” Vol.1
R. O. Dendy: Plasma Physics: An Introductory Course</td></tr>
<tr><td>其它（More）</td><td></td></tr>
<tr><td>备注（Notes）</td><td>考核方式及考核方式中各项比例根据教学实践可能有所调整。</td></tr>
</table>