PHYS 754  Condensed Matter Physics  2015

Offered: Semester  2
Credit:  15 points
Pre-/Co-requisites: None

Description
This course will introduce modern aspects of condensed matter physics. Topics include: ferroelectrics, phase transitions, liquids, glasses, amorphous solids and soft matter.

Aims
This course will develop the quantum and statistical mechanical foundation of condensed matter physics and apply it to phase transitions, the structure of disordered systems and soft condensed matter.

Skills and knowledge to be gained
Students who pass this course should be able to:

• have a broad overview of the quantum and statistical mechanical foundation of modern studies in condensed matter and soft matter physics
• understand how the techniques of molecular dynamics and Monte Carlo simulation play an important role in describing condensed matter and soft matter
• appreciate the model concepts used in the statistical mechanical properties of condensed matter
• apply the concepts of Landau theory in phase transitions
• explain how the scattering from non-crystalline materials can be understood
• understand how the techniques of condensed matter physics can extended to soft matter by a macroparticle approach
• detail the structure of colloids

Syllabus
• Harmonic crystal. Phonons as a field theory.
• Dielectrics and Ferroelectrics
• Landau Theory and the Ising Model
• Monte Carlo simulations: Metropolis and Creutz
• Amorphous Solids and Molecular Dynamics
• Theory of Liquids and Small Angle Scattering
• Soft Matter and Colloids
• Colloidal Stability and Fractal Scattering
Learning activities and teaching methods

<table>
<thead>
<tr>
<th>Description</th>
<th>Study time</th>
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<tbody>
<tr>
<td>Lectures 20 × 1-hour</td>
<td>20 hours</td>
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<tr>
<td>Assignments 3 X 5 hours</td>
<td>15 hours</td>
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<tr>
<td>Private study (3 hours/lecture)</td>
<td>60 hours (recommended)</td>
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Inclusive learning
Students are urged to discuss privately any impairment-related requirements face-to-face and/or in written form with the course convenor/lecturer and/or tutor

Assessment

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<tr>
<th>Form</th>
<th>Weight</th>
<th>Time</th>
<th>When</th>
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<tbody>
<tr>
<td>Assignments</td>
<td>30% (3 × 10%)</td>
<td>15 hours</td>
<td>weeks 3, 7, 11</td>
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<tr>
<td>Exam</td>
<td>70%</td>
<td>3 hours</td>
<td>exam period</td>
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Academic Integrity
The University of Auckland will not tolerate cheating, or assisting others to cheat, and views cheating in coursework as a serious academic offence. The work that a student submits for grading must be the student's own work, reflecting his or her learning. Where work from other sources is used, it must be properly acknowledged and referenced. This requirement also applies to sources on the world-wide web. A student's assessed work may be reviewed against electronic source material using computerised detection mechanisms. Upon reasonable request, students may be required to provide an electronic version of their work for computerised review. Please visit the below link for further information:


Resources

Lecture notes – available via Cecil

Feedback

Marked script and model solutions to assignments; marked exam script (if requested)

Enrolment

Typical enrolment Semester 2: 5