# Theoretical Solid State Physics

<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Theoretical Solid State Physics</td>
<td>11-TFK-Int-201-m01</td>
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## Module coordinator

Managing Director of the Institute of Theoretical Physics and Astrophysics

## Module offered by

Faculty of Physics and Astronomy

<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
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<tbody>
<tr>
<td>8</td>
<td>numerical grade</td>
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## Duration

<table>
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<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
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<tr>
<td>1 semester</td>
<td>graduate</td>
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## Contents

The contents of this two-term course will depend on the choice of the lecturer, and may include parts of the syllabus which could alternatively be offered as „Quantum Many Body Physics“ (11-QVTP).

A possible syllabus may be:

1. Band structure (Sommerfeld theory of metals, Bloch theorem, k.p approach and effective Hamiltonians for topological insulators (TIs), bulk-surface correspondence, general properties of TIs)
2. Electron–electron interactions in solids (path integral method for weakly interacting fermions, mean field theory, random phase approximation (RPA), density functional theory)
3. Application of mean field theory and the RPA to magnetism
4. BCS theory of superconductivity

## Intended learning outcomes

In-depth knowledge of the topics listed above. In-depth understanding of the concepts involved and ability to apply the methods listed. This provides a thorough working knowledge of a large number of topics treated in the standard textbooks on theoretical solid state physics.

## Courses

(type, number of weekly contact hours, language — if other than German)

V (4) + R (2)

Module taught in: English

## Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 to 120 minutes) or
b) oral examination of one candidate each (approx. 30 minutes) or
c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or
d) project report (approx. 8 to 10 pages) or
e) presentation/talk (approx. 30 minutes).

If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.

Assessment offered: In the semester in which the course is offered and in the subsequent semester

Language of assessment: English

## Allocation of places

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## Additional information

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<tr>
<th>Referred to in LPO I</th>
<th>(examination regulations for teaching-degree programmes)</th>
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<td>Module appears in</td>
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