## Module: Asymptotic Methods

### Code
740..

### Instruction language
English

### ECTS credits
4

### Credit hours
3

### Duration
1 semester

### Cycle
irregular

### Coordinator
Dean of Physics studies

### Lecturer
Dr. Maxim Efremov

### Allocation to study programmes
- Physics M.Sc., elective module, 1st or 2nd semester
- Wirtschaftsphysik M.Sc., elective module, 1st – 3rd semester

### Formal prerequisites
None

### Recommended prerequisites
None

### Learning objectives
The aim of this special lecture series is to provide students with a Bachelor or Master degree with advanced mathematical tools to solve different problems faced by physicists, engineers, and applied mathematicians. Each method is illustrated by both well-known and completely new examples of physics problems appeared within classical and quantum mechanics.

### Syllabus
Methods include but are not limited to:
- approximate solutions of transcendental equations,
- asymptotic calculus for integrals and sums,
- the saddle-point and contour integration methods,
- the WKB method and its generalizations for differential equations of different types,
- the methods of averaging.

### Literature
- N.G. de Bruijn, Asymptotic methods in analysis (Dover, 2010)
- C.M. Bender and S.A. Orszag, Advanced asymptotic methods for scientists and engineers: asymptotic methods and perturbation theory (Springer, 1999)
- E.J. Hinch, Perturbation methods (Cambridge University Press, 1995)

### Teaching and learning methods
- Lecture (2 hours per week)
- Exercise (1 hours per week)

### Workload
- 30 hours lecture (attendance time)
- 15 hours exercise (attendance time)
- 75 hours self-study and exam preparation
- Total: 120 hours

### Assessment
Written or oral examination. Form and scope of the examination is determined and notified by the lecturer at the beginning of the course.

### Examination
Written
<table>
<thead>
<tr>
<th>Grading procedure</th>
<th>The module grade is the examination grade.</th>
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<tbody>
<tr>
<td>Basis for</td>
<td>Research in the field of Quantum Information and Technologies</td>
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