

# Curriculum

## Doctoral Program “Mathematical Modelling and Application of Mathematics” Institute of Mechanics – Bulgarian Academy of Sciences

### First Year

1. **Language Training**
  - Academic and scientific English
  - Preparation for scientific communication and publication
2. **Computational and Numerical Skills (Elective Courses)**

Selection according to the topic of the doctoral thesis:

  - LaTeX for scientific writing
  - MATLAB / Python for numerical modelling and simulations
  - Scientific data analysis and visualization
  - Statistical methods for processing experimental and numerical results
3. **Specialised Courses (minimum of two)**

Selected from courses offered by the BAS Training Centre and/or the Institute of Mechanics, such as:

  - Optimisation methods
  - Numerical methods for differential equations
  - Parallel and high-performance computing
  - Machine learning and data analysis with applications in mechanics
  - Modern methods for processing sensor and experimental data
4. **Individual Research Plan – Stage I**
  - Formulation of the PhD research topic
  - Comprehensive literature review
  - Selection of mathematical models and research methodology
  - Initial analytical and/or numerical results
5. **PhD Seminar in Mathematical Modelling – I**
  - Presentation and discussion of ongoing research
  - Critical analysis of scientific publications
6. **Basic Theoretical Training and Examination in a Specialised Subject**
  - Preparation of an examination syllabus related to the PhD topic
  - Examination (written and oral)

### Second Year

7. **Research Ethics and Professional Development**
  - Scientific ethics and academic integrity
  - Publishing scientific results
  - Participation in conferences, workshops and research projects
8. **PhD Seminar in Mathematical Modelling – II**
  - Presentation of progress on individual research projects
  - Interdisciplinary discussions in applied mathematics and mechanics
9. **Individual Research Plan – Stage II**
  - Advanced analytical and/or numerical investigations
  - Analysis and interpretation of results
  - Preparation of scientific publications

## **Third Year**

*(for part-time and self-study doctoral students – until the expiration of the PhD enrolment period)*

### **10. Individual Research Plan – Stage III**

- Finalisation of research and numerical/experimental studies
- Systematisation and interpretation of results
- Preparation of the PhD thesis

### **11. Publications and Scientific Presentations**

- Preparation and submission of scientific papers to peer-reviewed journals
- Presentation of research results at international scientific conferences

### **12. Presentation of the Work Completed on the Doctoral Thesis**

- Presentation of published research results
- Final specification of the PhD thesis topic (no later than 3 months before the date of the meeting of the section for the preliminary discussion)

### **13. Defence of the PhD Thesis (within up to 5 years after the expiration of the PhD enrolment period)**

- Preparation and public defence of the doctoral thesis before a scientific jury
- Responses to questions and critical remarks by the members of the jury

## **Final Remarks**

The training programme provides PhD students with the necessary theoretical background, methodological tools and research skills for conducting independent scientific research in mathematical modelling, with applications in mechanics, engineering sciences and energy-related systems, fully aligned with the research profile and traditions of the Institute of Mechanics – BAS.