Examination Issues

Admission to the doctoral studies is determined by the result of the competitive examination. The assessment is made by the Qualification Commission appointed by the Head of the Doctoral Studies. The exam is a test of the candidate’s academic qualifications and predispositions for research work.

For all research directions

- **MATHEMATICS (level of studies at universities of technology)**
  
  Elements of analytic geometry and linear algebra,  
  Differential and integral calculus,  
  Ordinary differential equations of the first and second order  
  Theory of probability  

  **Literature:**  
  W. Stankiewicz, Zadania z matematyki dla wyższych uczelni technicznych, Part A and B, PWN 2009 (or other issue)

- **ENGLISH LANGUAGE**
  
  Translation of a technical text

**Major subjects depending on the discipline:**

- **MECHANICS, CIVIL ENGINEERING, MECHANICAL ENGINEERING**

**Fundamentals of continuum mechanics**

Fundamentals of the theory of elasticity and of the theory of plasticity  
Tensor analysis  
Stress/strain analysis  
The laws of conservation of mass, momentum and spin  
Elastic and plastic behaviour of materials  
Elasticity and thermodynamics
FUNDAMENTALS OF FLUID MECHANICS

Introduction to fluid dynamics
Ideal fluid
Viscous fluid
Dynamics of a fluid element
Incompressible fluid
Hydrodynamic similarity
Stokes law

LITERATURE


MATERIAL ENGINEERING

Physicochemical fundamentals of material formation
Material structures and methods of their characterization
Examination of physical, chemical and mechanical properties of single- and multi-component materials
Behaviour of materials under operating loads
Designing materials.

LITERATURE

Chapters of Vol. 1: 1.2, 2.2-2.6, 3.2-3.4, 4.2, 4.4, 6.2-6.5, 8.2-8.5, 9.3-9.6, 10.2-10.3, 11.2-11.4.
Chapters of Vol. 2: 13.2-13.5, 17.2-17.6, 19, PW1, PW2.

Sections: 1.2, 2.2-2.6, 3.2-3.4, 4.2, 4.4, 6.2-6.5, 8.2-8.5, 9.3-9.6, 10.2-10.3, 11.2-11.4. 13.2-13.5, 17.2-17.6, 19, GLU1, GLU2.

ELECTRONICS

Ultrasounds (or Acoustics)

Propagation of ultrasonic waves
Wave propagation velocity
Wave frequency
Wave power and intensity
Impedance of the acoustic medium
Reflection / refraction of waves at the border of media with different acoustic impedance

Basic LITERATURE
L. M. Brekhovskikh, R. T. Beyer, Waves in Layered media, Academic, New York, Chapter 1

Auxiliary LITERATURE
A. Nowicki, Podstawy ultrasonografii dopplerowskiej, PWN, Warszawa, 1995, Chapter 1
A. Śliwiński, Ultradźwięki i ich zastosowanie, WNT, Warszawa, 2001, Chapters: 2.2, 2.4, 3.1, 3.2.

Propagation of optical waves
Reflection and refraction of optical waves
The phenomenon of total internal reflection
Propagation in layered media
Optical Gauss' beams

Basic LITERATURE
M. Born and E. Wolf, Principles In Optics, University Press, Cambridge, Chapter 1
D. Marcuse, Light Transmission Optics, Van Nonstrand, New York, Chapters 1 and 6

Auxiliary LITERATURE
H. A. Haus, Waves and fields in optoelectronics, Prentice-Hall, Englewood Cliffs, Chapters 1, 2 and 5.
Landau, Lifszyc, Elektrodynamika ośrodków ciągłych, PWN, Warszawa, Chapter 10

- COMPUTER SCIENCES

Basics of computer arithmetic
Numerical optimization
Solving systems of linear equations
Numerical integration of ordinary differential equations
Solving nonlinear equations
Fast Fourier Transform

Literature:

The result of the qualification procedure will be available at the Secretariat of Doctoral Studies.