



Master's program Entrance examination topics

Physics

You are required to be familiar with three out of the seven topics listed below. You may choose which topics you want to cover. During the exam, the focus will be on depth rather than breadth, meaning you will be asked detailed questions about your selected topics. Therefore, it is perfectly acceptable to study only a few specific chapters of physics—just make sure you understand those topics thoroughly.

1. Principles of classical mechanics: Newtonian and Lagrangian mechanics
2. Principles of thermodynamics: energy, entropy, first and second law of thermodynamics
3. Electrostatics and magnetostatics: electric and magnetic fields, force laws, potentials, current flow
4. Maxwell's equations, important classes of solutions, physics of electromagnetic waves
5. Elements of quantum mechanics: wave-particle duality, Schrödinger equation, measurements in quantum mechanics
6. Operation of solid-state electronic devices: transistors, integrated circuits, LEDs and lasers
7. Principles of optics, operation of basic optical devices (lenses, telescopes, microscopes)

Recommended literature:

N. Gershenfeld, *The Physics of Information Technology*. Cambridge University Press, 2000.

Feynman lectures on physics (corresponding chapters) <https://www.feynmanlectures.caltech.edu> , Magyarul: R. P.

Feynman - R. B. Leighton - M. Sands: Mai fizika

Further references for Hungarian speakers:

Simonyi - Zombory: *Elméleti Villamosságtan*. Műszaki Könyvkiadó, 2000.

Csurgay - Simonyi: *Az információtechnológia fizikai alapjai*. Mérnök-továbbképző Intézet, 1997.

Simonyi Károly: A fizika kultúrtörténete



Electronics

You are required to be familiar with two out of the six topics listed below. You may choose which topics you want to cover. During the exam, the focus will be on depth rather than breadth, meaning you will be asked detailed questions about your selected topics. Therefore, it is perfectly acceptable to study only a few specific chapters of physics—just make sure you understand those topics thoroughly.

1. Concentrated parameter circuits, building block of an electrical circuits: linear and non- linear building blocks. Kirchhoff equations, Ohm's law, laws describing current-voltage characteristics of various circuit components.
2. Solution of the circuit equations in time domain and frequency domain, circuit simulator programs.
3. Methods for the analysis of linear circuits in frequency domain.
4. Some problems of Boolean circuit design: logic circuits, logic functions design trade-offs (speed, area, power).
5. Describe the operation of an arbitrary electronic circuit of your choice. Examples include but not limited to: amplifiers, converters (step up/down), microcontroller, LED driver, A/D converter, ALU unit.
6. Overview of microelectronics. Chip design, basics of microelectronics fabrication, fabless microelectronics.

Recommended literature:

Schultz, Mitchel E. *Grob's basic electronics*. McGraw-Hill, 2011.

Razavi, Behzad: *Fundamentals of Microelectronics*, Wiley, 2007.