Instructions for the Complex Examination
ELTE Doctoral School of Physics

The purpose of the complex examination is that the PhD student should give an account

(i) about his/her knowledge acquired from the completed compulsory courses as well as about his/her general overview on his/her discipline of physics

(ii) about the progress achieved in his/her research activity

Excerpts from the By-laws of the Doctoral School:
„The Complex Examination is carried out publicly in front of an assigned committee. The Complex Examination Committee consists of at least three and at most four members, and at least one member of the Committee must not be an employee of ELTE. The chairman of the Examination Committee should be a full professor, or a professor emeritus/emerita, or a lecturer/researcher with the Doctor of Science title of the Hungarian Academy of Sciences and habilitation, who is an employee of ELTE. All members of the Examination Committee must have earned a scientific degree (equivalent to a PhD). The supervisor of the PhD student must not be a member of the Examination Committee.
The Complex Examination is divided into two major parts: on the one hand, the theoretical knowledge of the student is investigated („theoretical part"), on the other hand, the student gives an account about his/her progress in the chosen research field („dissertation part").
In the theoretical part of the exam, the student is examined for his/her knowledge in a major subject and two secondary subjects." „Should the student fail at the theoretical part of the exam, he/she will be given one more chance within the same examination period to repeat the exam(s) of the subject(s) failed." In the second part of the complex exam (dissertation part), the student gives an account about his/her research in the form of a presentation."

(i) Students are suggested to prepare themselves for the theoretical part like for a comprehensive exam, by concentrating, instead of the details, rather on the essential issues, on a comprehensive overview. The timing schedule is the following: 30 and 15 minutes for the major and for each of the secondary subjects, respectively. 15 minutes are provided for preparation. The committee evaluates the student in each subject on a scale between 1 and 4. By taking the score of the major subject with a double weight, the average score of the exam is established and this is converted into a qualification by text.

(ii) As indicated by the above excerpts, a great emphasis is laid, in conformity with the corresponding National Regulations, on the dissertation part of the complex examination. The students should prepare themselves for this part of the exam by a 15- minutes-presentation, which is followed by a 10-minutes-discussion. The Examination Committee should decide, on the basis of this exam and on the research results achieved, whether it is realistic that the student will be able to complete the PhD studies within the susbequent two years. In the first part of the presentation, after a short introduction (it should be kept in mind that, by that time, the four semester reports of all students will be available at the homepage of the Institute), the students should present the results of their research accomplished until then. In the case of multiauthored activities, the own personal contribution should be clearly specified. In the second part of the presentation, the student should list the tasks necessary for successfully completing the planned dissertation, and the time schedule of their accomplishment (when and where the publications are expected to appear). Students are requested to present to the Committee the print-outs of all their papers (reprints, preprints) which have already been published or accepted or submitted.

The time schedule of the Complex Examination (taken very seriously by the Committee):
0.-5. min.: distribution of the exam tasks; 6.-20. min.: technical preparation for the presentation and the preparation of the student for the distributed theoretical tasks; 21.-45. min.: dissertation part (presentation: 15 min., discussion: 10 min.); 46.-105. min.: theoretical part; 106.-120. min.: evaluation of the exam in a closed session of the Committee and informing the student about the result of his/her exam.

List of complex examination topics

In Programs I-III and V one can choose the *main topics* from the following list:
Astrophysics, Space Physics and Planetary Systems, Biophysics, Materials science, Quantum mechanics, Atomic and molecular physics, Nuclear physics, Optics, Particle Physics, Statistical physics, Solid state physics, Network theory,
In Program IV (*Physics education program*) the main topic is Physics education.

Secondary topics in Programs I-III and V (all optional):
Solar Physics, Physics of the Solar System, Celestial mechanics, Galactic astronomy, Stellar astrophysics, Physics of the interstellar medium, Extragalactic astronomy, Cosmology, High energy astrophysics, Physics of exoplanets and exoplanetary systems, Signal processing. Data-intensive and machine learning methods. Molecular biophysics, Bioinformatics, Methods of physics in biology, Evolution theory, Environmental physics, Mathematical foundations of relativistic quantum theory, Renormalization and the renormalization group, Optical and particle spectroscopy, Plasma physics, Heavy ion physics, Reactor physics and radiation protection, Applications of nuclear methods, Theory of gravitation, Quantum information, Experimental quantum mechanics, Quantum optics and lasers, Quantum electrodynamics, Low energy hadron physics and nonperturbative quantum chromodynamics, Quantum chromodynamics, Phenomena and theory of electroweak interaction, Experimental methods and data processing in particle physics, Chaotic systems, Growth phenomena and pattern formation, Phase transitions and critical phenomena, Computational methods in statistical physics, Hydrodynamics, Defects in metals and insulators, Mechanical properties of solids, Experimetal methods in solid state research and material science, Liquid crystals, Magnetic properties of condensed matter, Optical properties of condensed matter, Many-body problem, Mesoscopic electron systems, Carbon nanostructures, Topological insulators, Computational methods in material science and solid state physics, Physics of amorf materials and nanostructures, Physics of membranes and macromolecules; Nuclear astrophysics; Standard model of particle interactions; Beyond the standard model; Particle astrophysics
Secondary topics in Program IV (*Physics education program*) can be chosen by merging two topics of the following list:
Hystorically relevant experiments of Physics, Foundation of the theory of relativity Plausible quantum theory, Physics of elementary particles, Energetics and environment, Physics of environmental flows, Chaotic mechanics, Versatile use of computers in pyhsics education, Cooperative phenomena, interdisciplinary aspects, Physics in biology, Physics in chemistry, Recent results in astronomy and space science