

## Modern Physics Examination syllabus

1. The absolute frame of reference, the Michelson-experiment. The special theory of relativity. The Lorentz-transformation. Basic concepts of relativistic dynamics. The variation of mass with velocity. Mass energy equivalence. Cockroft-Walton experiment. Experimental basis of quantum physics.
2. Blackbody radiation, the molar heat capacity of solids at low temperature. Photoelectric effect, the birth of the photon concept.
3. Compton scattering. Line spectra of atoms. Bohr's postulates. Franck and Hertz experiment.
4. The Bohr model of hydrogen. The explanation of line series.
5. Wave particle duality of particles, de-Broglie hypothesis. Concept of wave packet. Experimental verification of wave particle duality. Two-slit interference of electrons.
6. The Heisenberg uncertainty principle and the consequences. The Schrödinger equation of quantum mechanics. The meaning of the wave function. Quantum mechanical description of the motion of a free particle.
7. Travelling through a potential step. Tunnelling through a rectangular potential barrier. Application of tunnel effect. The quantum mechanical model of the Hydrogen atom. The electron spin.
8. The X-ray spectra. The continuous X-ray spectrum, the characteristic X-ray spectrum. Quantum optics, physical basic of laser operation. Stimulated emission, population inversion. Different lasers.
9. Nuclear physics. Discovering the nucleus, Rutherford experiment. Nuclear interaction. Radioactivity  $\alpha$ -,  $\beta$ -,  $\gamma$ -, radiation. The laws of radioactive decay. Radioactive decay series. Detection and measurement of radioactive radiation. Biological effects of radiation.
10. Mass defect and nuclear binding energy. Nuclear fission. Chain reaction. The nuclear reactor. Nuclear fusion.