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# Физическое образование в вузах

# Журнал «Физическое образование в вузах»

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## Physics in Higher Education

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## **The Decision of XII International Conference «Physics in System of Modern Education» (PSME-12)**

Summary record about the conference which has passed from June, 03ed till June, 06th, 2013 in Petrozavodsk on the basis of the Petrozavodsk State University.

## **The Decision of Participants in the International Workshop, Held in Moscow on 24-26 June, 2013**

Summary record about the International Workshop which has passed from June, 24th till June, 26th, 2013 in Moscow on the basis of the Moscow Aviation Institute (National Research University).

## **The National Physics Student Contest (Olympiad) in National Research Nuclear University «MEPhI» in 2013. The Organization and Conduct Experience**

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The analyses of the experience of conducting of the National Contest in Physics among students in NNRU «MEPhI» is presented. The results of the Contest are discussed.

*Keywords:* National Contest in Physics among Students.

## **Net-Interaction Experience in Herzen University**

N.I. Anisimova, G.A. Bordovsky, V.A. Bordovsky, V.I. Seldyaev, E.U. Semenova

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In the article aspects of net-interaction experience realized in Herzen University are under discussion.

*Keywords:* net interaction, net-master program, school-university interaction.

## **Urgent Aspects of the General Physics Course Realization in the Master of Science (Magister) Programme in National Research Nuclear University «MEPhI»**

I.N. Zavestovskaia<sup>1,2</sup>, N.P. Kalashnikov<sup>1</sup>, O.N. Krokhin<sup>1,2</sup>, S.S. Muraviev-Smirnov<sup>1</sup>

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The methods of the learning in general physics in the Master of Science (Magister) in National Research Nuclear University «MEPhI» are described. The general physics course in the Master of Science (Magister) Program is given, and the generalization of authors' learning experience with the Masters of Science is proposed.

*Keywords:* the learning in general physics, the methods of the learning, General Physics Course, magistracy.

## **Methodical Training of Students in the Field of «Pedagogical Education», Master's Program «Physical Education»: Implementation Experience**

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Experience of implementation of master's program «Physical education» is represented. The system of methodical training of master students, the role of work practice in this process and the system of assessment of the achievements of professional competences in accordance with the requirements of federal state educational standard are considered.

*Keywords:* federal state educational standard; professional competences of teacher; work practice; methodology of teaching physics.

## **General Physics Course Evolution from Khvolson till Nowadays**

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Evolution of general physics course during XX century is analyzed. It is shown that in the middle of the last age the transformation from inductive-historical to deductive-theoretical paradigm in physics teaching took place. As a result we have a lot of short handbooks and dictionaries instead of serious textbooks which are not necessary for test – examinations.

*Keywords:* general physics teaching, theoretical and experimental content of the physics course, federal state educational standard, exemplary general physics program.

## **On Innovative Methods in Teaching of General Physics at a University**

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Innovative methods in teaching of general physics the first year university students with

insufficient school training in physics and mathematics are proposed. The test results and the influence of those methods on the academic progress of two groups of the first and second year students are analyzed.

*Keywords:* united state examination, input control, the program of the general physics course.

## **Adaptation of Students to Modular Technology Education**

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This article examines the didactic conditions adaptation of students to modular technology education. In addition, describes a method to identify students' abilities to adapt to the educational environment.

*Keywords:* modular system of education, technology, control of knowledge, adaptation.

## **Improvement of the Motivation Component of Students' Physical Education at the Civil Engineering Department**

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The article describes the possibility to increase the quality of teaching Physics at the Civil Engineering Department applying methodological back-up of the course. The course is adapted to the profile of the given specialty and has been created in view of interdisciplinary links between Physics and other subjects and student selected professional activities.

*Keywords:* motivation increase, intersubject communications, physics for builders.

## **The Capacitor Charging as Non-Equilibrium Thermodynamic Process**

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On the base of the first thermodynamics law the illustrative problem revealing the influence of charging rate on the energy stored by capacitor is considered. For the case of quasistatistical processes in limit the coefficient of efficiency value is equal to 1, that has been forecasted. The maximum of dissipative losses curve is found in the extremely non-equilibrium process domain.

*Keywords:* non-equilibrium process; thermodynamics first law; capacitor charging; model; relaxation.

## Educational Radio-electronics Laboratory: Analog Section

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Updated structure of general radio-electronics practicum for students of physics faculty at M.V. Lomonosov Moscow State University is presented. Difference of new methodical decisions from a traditional practical training consists in the individualization of development which is carried out on in advance prepared template, flexible structure of a new series of trainings, expansion of functionality of carried-out measurements. Introduction the SPICE modeling allows to acquaint students with a full spectrum of standard tests for radio-electronic production – load's, frequency amplitude and phase, pulse characteristics. Additional students activity, processing of results and creation of reports takes place via NX service, providing to students the adjusted working environment for modeling, analysis of results and maintaining own database of the performed works.

*Keywords:* general physics practicum; radio-electronics; SPICE modeling; analog electronics.

## Lessons of Nanoelectronics. 3. Electronic Conductivity and Conductivity Modes by «Bottom–Up» Approach

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General questions of electronic conductivity, conductivity modes,  $n$ - and  $p$ -type conductors and graphene are discussed in the frame of the «bottom – up» approach of modern nanoelectronics.

*Keywords:* nanoelectronics, molecular electronics, bottom – up, electronic conductivity, conductivity modes,  $n$ -type conductor,  $p$ -type conductor, graphene.

## Harking Back to Theme of the Superconducting Sphere in an External Magnetic Field

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The aim of this article is to give the student's understanding of the available evidence that hollow superconducting sphere (superconducting shell) behaves as a point magnetic Dipole: 1) in a uniform external magnetic field, 2) in the point dipole, placed in its centre. The way evidence is

based on minimizing equation integral equation for London to vector-potential. It is an alternative to the traditional equation of London is closed with the decision of Maxwell's equations for the surface of the Superconductor. For a solid sphere (ball) integral equation can be solved completely.

*Keywords:* Meissner effect, London's equation, vector-potential.

## **Light Interference at Reflection from Thin Plates and Films**

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Possible ways to obtain and conditions for observation of monochromatic light waves interference at reflection from thin transparent plates and films are considered. It is shown that besides well known cases – stripes of an equal thickness and an equal inclination – there is one more possibility to obtain of interference of the reflected light beams – formation of so-called stripes of equal optical density (or «an equal refraction»). Properties of structures with periodic change of refraction index – photonic crystals are discussed. As a special case, Bragg's condition for diffraction of X-rays is received.

*Keywords:* light interference, refraction index.

## **Contactless Measurement of Electrical Resistance in Alternating Magnetic Field. Part 1**

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There is given the description of the laboratory setup for the measurement of the emf induced by inductive currents of the test specimen. The measurements are made by the compensation of a signal from an external alternating field. The test specimen is a short-circuit single-layer solenoid. The problem has an exact solution. The described experimental method is the basis of an improved method based on Maxwell's equation (Part 2).

*Keywords:* laboratory work, Faraday law of electromagnetic induction, alternating magnetic field, compensation method, contactless measurement of current and conduction.

## **Contactless Measurement of Electrical Resistance in Alternating Magnetic Field. Part 2**

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Introduced in Part 1 method of contactless measurement of conduction is applied for massive conductors with cylindrical symmetry. On the basis of Maxwell's equations in the

quasi-static approximation the exact solutions in a wide frequency range were obtained. All calculations are presented in a form suitable for the analysis of the experimental measurements. Doing the work a student integrates physics, mathematics and information technology.

*Keywords:* laboratory work, altering magnetic field, Maxwell's equations, the exact solution in a wide frequency range.

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