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METHOD OF CONDUCT OF PRACTICAL AND LABORATORY COURSES IN PHYSICS BASED ON INTERDISCIPLINARY INTEGRATION

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Abstract:

In the article, the model of conducting practical and laboratory training in physics based on interdisciplinary integration and the effective organization of laboratory and practical training taking into account the specific features of students' career guidance and specialization in the construction industry are considered in detail with the help of examples, and suggestions and recommendations for the effective organization of independent work are presented.

Keywords

Physical science, practical training, laboratory training, interdisciplinary integration, competence, construction field, general engineering sciences, independent education.

Introduction

In the era of high development of science and technology, the main criterion of the quality of education is that the preparation of the graduate of the higher education institution is at the level of modern requirements is being considered. In this regard, the issue of guaranteed education, which allows rapid implementation of knowledge, qualifications and skills in the future professional activity, is considered urgent. The solution to this problem is based on applying the theory to practice.

Physics laboratory training is an integral and important part of effective teaching of physics. For this reason, during laboratory classes in physics at the Tashkent University of Architecture and Construction, more attention is paid to directing students to the fields of architecture and construction and to the process of interdisciplinary integration.

For example, in the laboratory work called "*Determination of Yung's modulus by bending method*", good mastering of concepts and quantities such as deformation phenomenon, Guk's law, Yung's modulus, relative and absolute elongation, strength limit, mechanical stress, is important in the future scientific and work activities of future construction engineers plays a role.

At the same time, it creates the ground for full mastery of such subjects as resistance of materials, reinforced concrete and stone structures, metal structures, wooden structures. In this case, the integration of the physical concepts learned during the implementation of laboratory work into the general engineering sciences is presented in the figure below (Figure 1).

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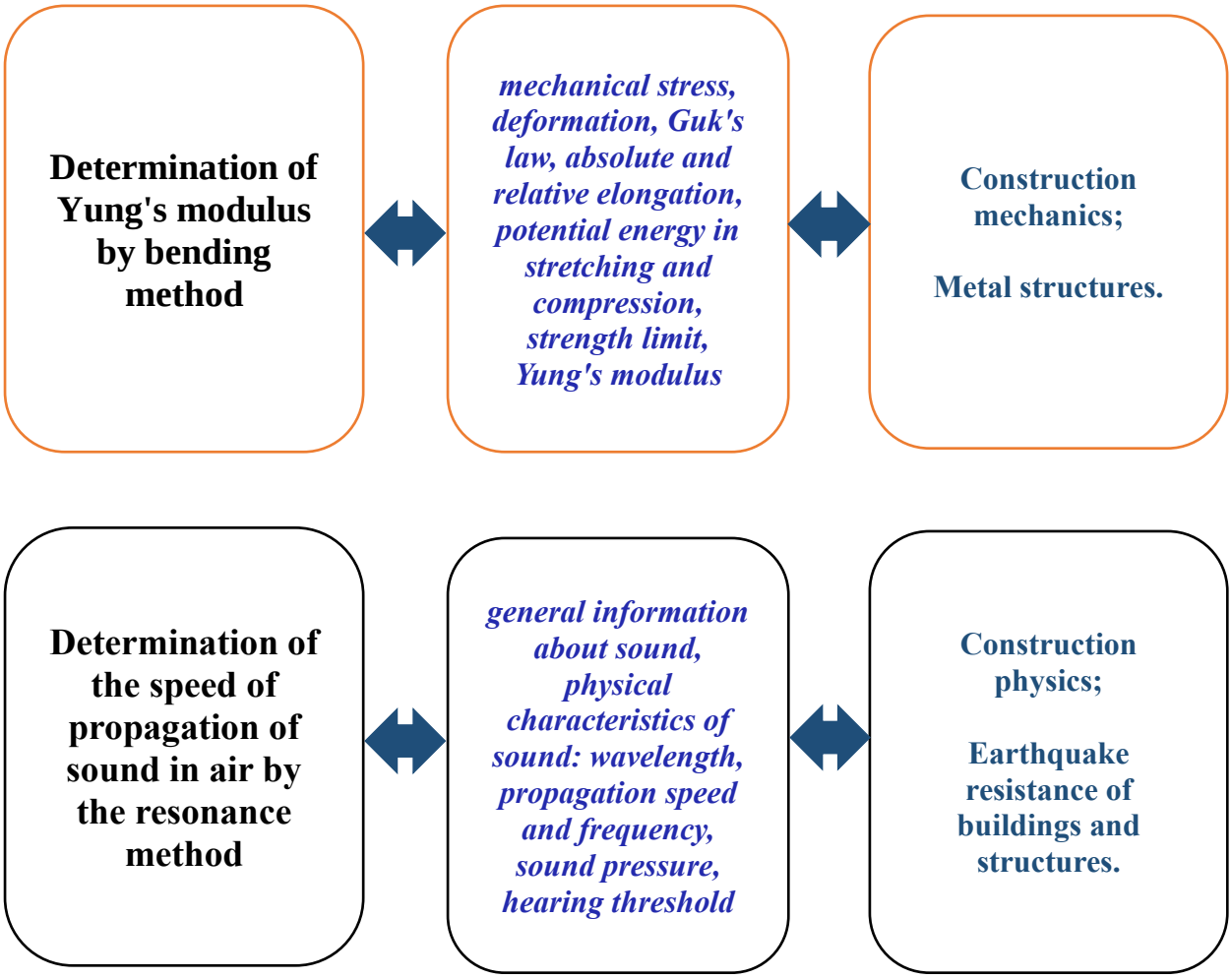

Figure 1. Integration of laboratory subjects into general engineering subjects.

By completing the laboratory work entitled "Determining the acceleration of free fall using a mathematical pendulum", they will learn about concepts such as mechanical vibrations, mathematical pendulum, harmonic vibrations and acceleration of free fall. At the same time, we believe that it is necessary to pay close attention to the areas of application of pendulums in the field of construction during the course of the lesson.

An example of this is the inertial damper used in the building "111 West 57th Street" built in the USA (Fig. 2). It is considered the "thinnest skyscraper" and is 438 meters high and 18 meters wide. It is planned to install an inertial damper weighing 800 tons. This damper is used to maintain the balance of the building against the effects of earthquakes and wind.

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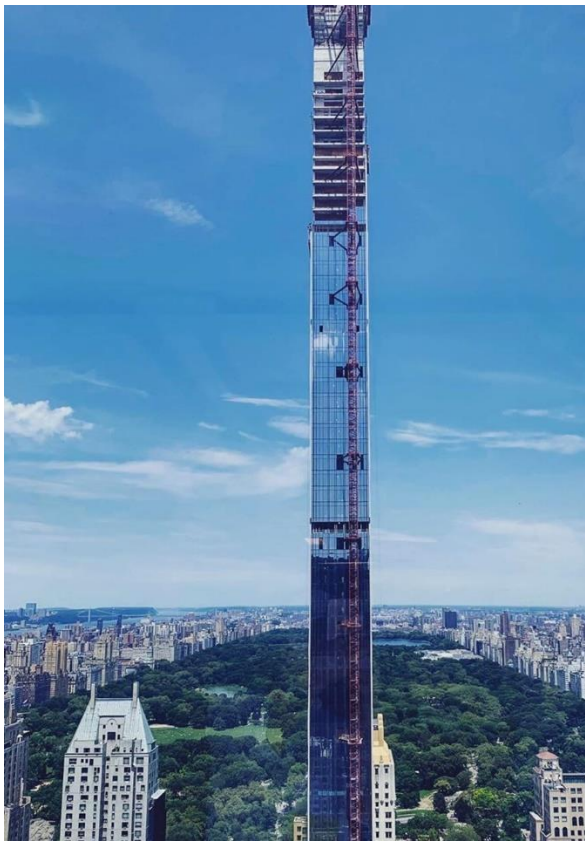

Figure 2. General view of 111 West 57th Street.

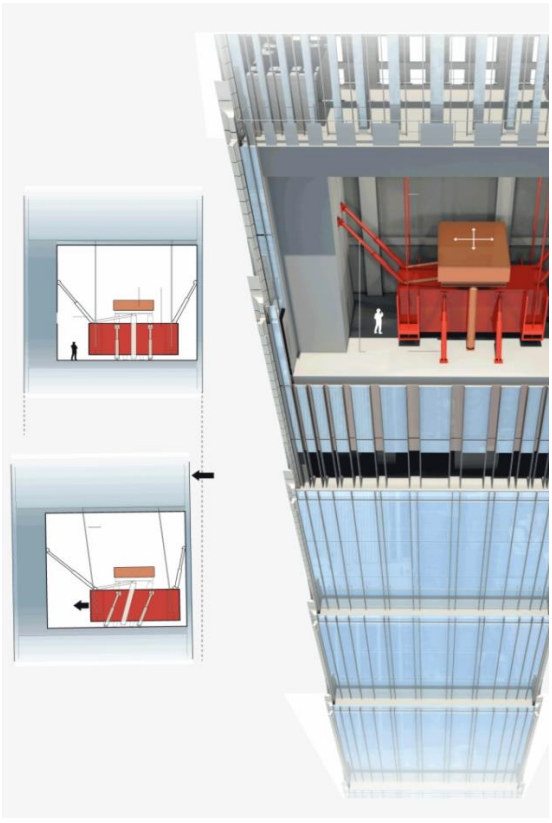

Figure 3. Overview of the Inersion-dempfer.

An inersion dempfer consists of two superimposed loads, one of which is suspended from a cable, and the other is fixed to the base (Fig. 3).

In the laboratory exercise called "Determining the speed of sound propagation in air by the resonance method", sound waves, will have the concept of the mechanism of sound propagation in air, and the phenomenon of resonance. In this regard, we consider it appropriate to provide brief information about the negative effects of the resonance phenomenon on construction, buildings and structures and methods of its elimination. In the field of construction, the main task of sound waves, that is, acoustics, is to study the conditions that determine the sound of speech or music in rooms, to develop architectural planning and design solutions that provide optimal conditions for hearing.In the laboratory exercise called "Determining the speed of sound propagation in air by the resonance method", you will learn about sound waves, the mechanism of sound propagation in air, and the phenomenon of resonance. In this regard, we consider it appropriate to provide brief information about the negative effects of the resonance phenomenon on construction, buildings and structures and methods of its elimination. In the field of construction, the main task of sound waves, that is, acoustics, is to study the conditions that determine the

sound of speech or music in rooms, to develop architectural planning and design solutions that provide optimal conditions for hearing.

The acoustic quality of buildings depends on:

- to the shape of the room;
- the size of the room;

-consists of creating and placing the profile of individual surfaces, for example, walls, ceilings, sound-absorbing materials.

Professionally oriented laboratory work in physics and general engineering and the types of competence formed as a result are presented in Table 1 below.

Table 1.

Competencies to be formed / **Laboratory work**		**Physics science**	**General engineering sciences**
Professional competence-5	Quality control of materials and structures used in construction.	Determination of Yung's modulus by bending method.	**Construction mechanics** 1).Testing various materials for compression deformation. Determination of stability limits. 2).Determining the bending strength of a wooden beam 3). Testing the twisting of a circular cross-section rod.
Professional competence-6	Control of compliance with construction technology of residential, public and industrial buildings.	Determination of the coefficient of internal friction of liquids by the Stokes method.	**Fluid and gas mechanics** 1). Study of two-order movement of liquid. 2). Determination of local resistance coefficient.
Professional competence-4	Compilation and application of computational-technological maps of some technological processes of various construction objects.	Study of gas laws.	**Fluid and gas mechanics** Pressure measuring instruments.
Professional competence-9	Implementation of design, construction, reconstruction and repair works of construction objects.	Determination of solar collector efficiency as a function of thermal insulation.	**Building materials and products** Using sunlight.

Alternatively, virtual labs can also be used effectively. When using virtual laboratories, all professional skills of future civil engineers are formed and developed at the same time. As you know, the Carnot cycle is a classic example for understanding the irreversible processes that underlie the operation of many heat pumps and refrigeration machines. As a rule, the detailed study of all stages of this cycle and the calculation of all relevant parameters occur most effectively during laboratory work on this topic in physics. In our opinion, the above is also a solution to the problems of overloading students and saving class time.We can also analyze laboratory works dedicated to gas migration phenomena and proposed for civil engineering students. The theoretical materials of this work are very important for future civil engineers. Because all theoretical bases of heat transfer processes through construction barriers are directly considered here. Also, the specificity of a certain construction direction is practically realized in laboratory exercises. In order to implement the above-mentioned works, it is desirable to establish close cooperation between professors and teachers of physics and general engineering. It is known that the credit-module system has been introduced into the educational process of many higher educational institutions. The credit system is a unit of measurement that shows the result achieved, not the number of hours studied in the educational process. That is, it is a result-oriented measurement unit that assesses the level of competence of a specialist. Therefore, the credit is not only a grade given to the educational activity, but also a unit indicating the completed educational load. The introduction of the credit-module system is an important factor in the cooperation between the professor and the student. In modular education, the pedagogue organizes, directs, advises and monitors the student's learning process. And the student moves independently towards the directed object. The greatest emphasis is placed on independent education of students. The importance of independent education in the educational process increases, and this will lead to an increase in the independence, creative initiative and activity of specialists in the future. The sequence of effective organization of independent education is presented in Figure 4 below.

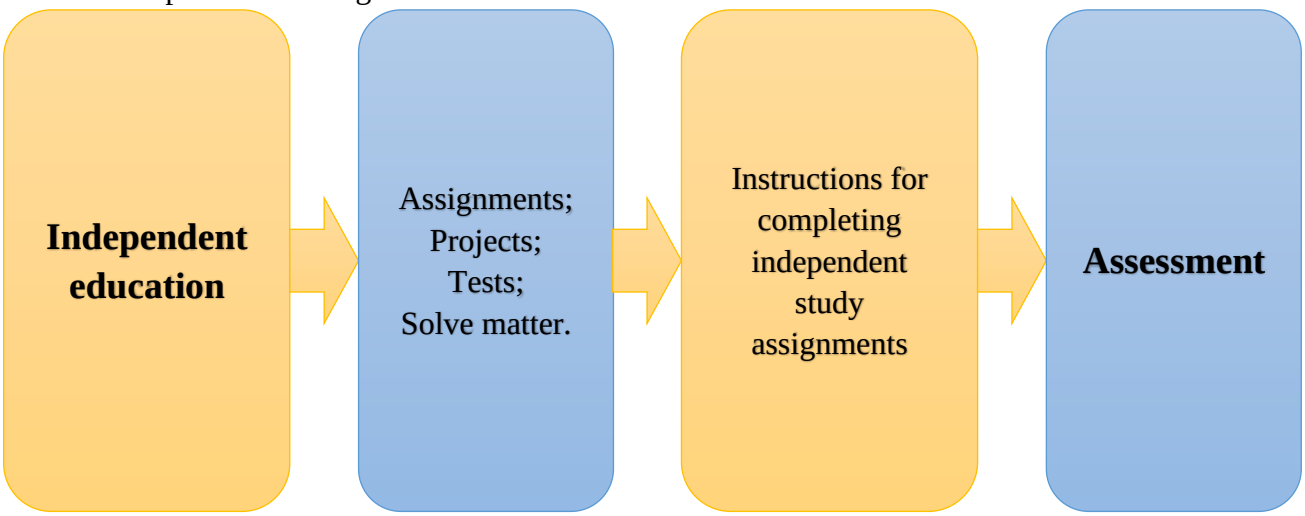

Figure 4. The sequence of effective organization of independent education.

In the credit module system, the student spends 40% of the study load in the classroom, and 60% is studied independently. Audience hours are down 56 percent. The student's time allocated to independent education increased by 47% on average. Therefore, the correct and effective organization of independent education has a positive effect on the quality of education.

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