METHODY PROCEDURE AND CARRYING OUT LABORATORY WORKS OF A PROFESSIONAL CHARACTER

Kurbanov Khayotjon Mirzakhmedovich
Assistant, Tashkent State Transport University, Tashkent, **UZBEKISTAN**

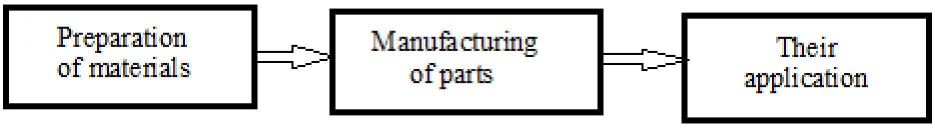
ABSTRACT

The article discusses a physics laboratory practice, containing the performance of laboratory work of a professional nature, helps to improve the quality of mastering the course of general physics, development of creativity and professional outlook on training, acquaintance with the latest achievements of science and technology, preparing a solid foundation for further mastering the course of general engineering and special disciplines studied in technical universities.

Keywords: Interference, interferometer, concentration, current carrier, charge, electron, electric field, magnetic field, Ampere force, Lorentz force, fiber, photocell, lens, laser, diode, transistor.

INTRODUCTION

General engineering and professional tasks solved by teams of engineering and technical workers can be represented as the following schema:



The general engineering and construction task includes the preparation of appropriate building materials (wood, sand and other natural resources), manufacturing of construction elements (panels, frames and other details), construction of buildings, bridges, roads and other national economic communications. And the general tasks of engineering automation: preparation of materials (conductors, semiconductors, dielectrics), production of automation elements (diodes, transistors, microcircuits for various purposes), their application in automation (automatic traffic control, electromechanics and computer engineering, railway engineering, power supply, etc.).

The task of each section of the specified scheme is design, study of the acceptability of selected and prepared materials, quality control of materials and processing, testing, etc. To solve these problems, various methods are required: general physical, especially physical, calculated, economic. The main provisions of methods for solving engineering problems are consideredes by general engineering and special disciplines studied in the senior years of a technical university.

However, some of them can be considered at laboratory-practical lessons of the course of general physics. For example, quality control of surface treatment of semitransparent solids, study of their electrical properties, determination of some operational parameters of manufactured devices are successfully considered in a physics laboratory practice. Such work can be called professional laboratory work. They, along with the deepening of physical knowledge, prepare the basis for mastering general engineering and special disciplines, increase interest in the chosen specialty. [3].

Consider several laboratory works of a professional nature included in a laboratory practice for students, Tashkent State Transport University (TSTU) learners on the profile construction, electromechanics and computer engineering, railway transport engineering, transport systems management.

Quality control of the surface of processed semi-transparent materials by the interference method

It is known that the surface properties of the materials used play a decisive role in the manufacture of electronic devices. The control of these properties is possible using sufficiently accurate methods of surface diagnostics.

One of the most common methods for studying them is optical microscopy in combination with preliminary chemical or ionic etching of the sample. One of the most common methods for studying them is optical microscopy in combination with preliminary chemical or ionic etching of the sample.

Chemical etching in order to detect defects is based on the fact that the rate of oxidation of the sample in the place where the defect is located is significantly different from the rate of oxidation of the defect-free regions. In most cases, the rate of material oxidation in the vicinity of the defect is higher than in the neighboring areas, resulting in the formation of etching pits. In some cases, the rate of oxidation of defects turns out to be lower than that of a defect-free crystal, then tubercles are formed at the locations of defects. The formed etching pits and tubercles are easily studied using the Linnik, Jamen, Michelson interferometer [4, 57-194].

One of the interfering rays is reflected from the mirror, the other - from the surface under study. If there are pits or tubercles in the surface, the rays acquire an additional path difference, as a result of which the interference pattern observed on the eyepiece is curved (Fig. 1).

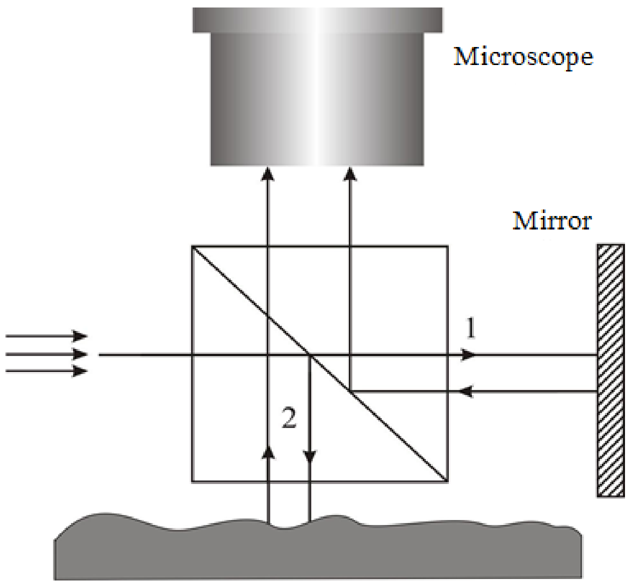


Fig-1. Interferometer MII-4. Plane light wave (parallel beam of light) from the source is directed to beam splitter and is divided by it into two waves 1 and 2.

If there is a groove (fossa) on the investigated surface with a depth $\frac{\lambda}{2}$ then, As the light passes the furrow twice, an additional path difference equal to Δ occurs, and the interference fringe is bent and reaches the fringe corresponding to the minimum of the next order. The greater the height of the roughness or the depth of the scratch, the greater the curvature of the stripes (Fig. 2).

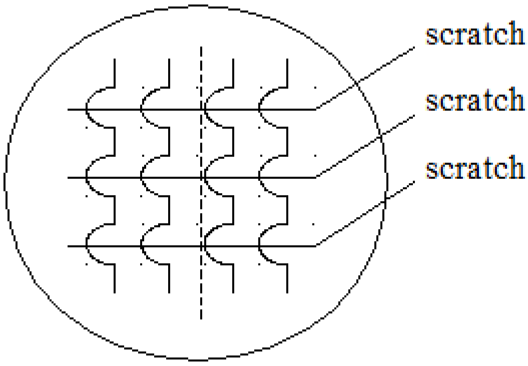


Fig-2. Interference surface control method.

Likewise, all interference fringes perpendicular to the groove are curved (will reach the band corresponding to the minimum of the next order). In this case, the observed amount of curvature will be equal between the bands. If the magnitude curvatures is equal to N, then the furrow depth $d = N\frac{\lambda}{2}$. Magnitude N can be found as the ratio of the amount of curvature in the strip to the distance between the stripes. Then the furrow depth is determined by the expression: $d = \frac{b}{a} \cdot \frac{\lambda}{2}$.

In the course of performing this laboratory work, students should be aware of the goals of the surface quality control method under consideration, the possibilities of its application, and the high measurement accuracy in the order of the wavelength of light. [1].

Determination of the concentration of the main current carriers in semiconductor materials

This laboratory work studies the nature of the motion of charged particles in electric and magnetic fields. It is known that in a semiconductor sample (or conductor), placed in an electric field, free current carriers under the action of this field ($\vec{F} = q\vec{E}$) come into directional motion. f a magnetic field perpendicular to the electric field is applied to the sample, then under the action of the Lorentz force ($\overrightarrow{F_L} = q[\vec{v} \cdot \vec{B}]$) the direction of movement of the carriers will change – the velocity component will appear, which is perpendicular to both fields. This, in turn, causes the excitation in the same direction of an electric field called the Hall field.

Students are offered a scheme of the experiment (Fig. 3) and samples with known types of carriers, with the help of which, by measuring the Hall voltage and using the expression $n = \frac{IB}{U_x ea}$, determine their concentration.

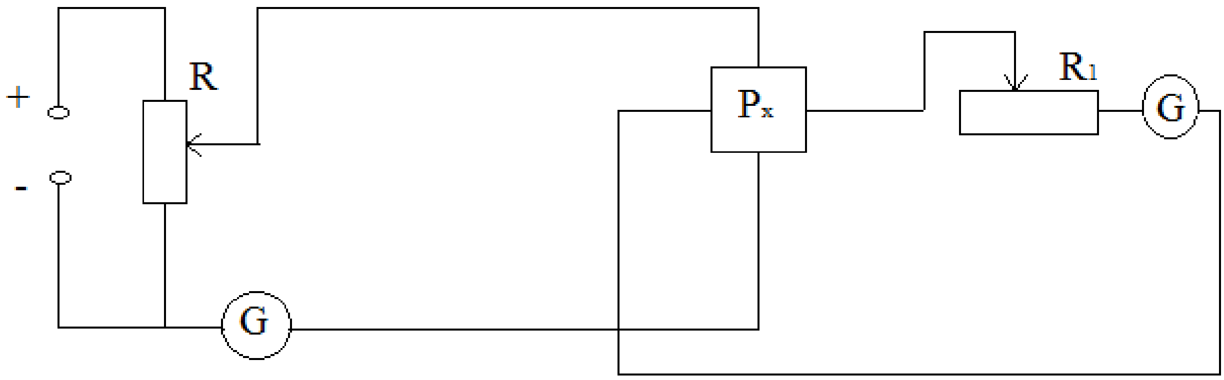


Fig-3. Scheme for determining the concentration of the main current carriers in semiconductors.

This experience is included in the group of professional character laboratory work, since some of the electrophysical properties of samples can be studied using the phenomena considered in the course of general physics. At a practical work on special physics, students in senior courses in the same work consider a fairly wide range of phenomena- investigate the types of carriers, determine their mobility.

By studying this phenomenon, a Hall sensor has been developed, which detects some of the laboratory work of magnetic inductions.

Studying the properties of p-n and n-p-n junctions

Laboratory work to study the parameters of p-n and n-p-n junctions is based on their determination from the current-voltage characteristic (VAC). Students, after making the appropriate changes, will build a CVC curve [5,78-85; 207-229]. By rectilinear section is used to determine the dynamic forward and reverse resistance of the diode: $R_d = \frac{\Delta U_d}{\Delta I_d}$; $R_r = \frac{\Delta U_r}{\Delta I_r}$ and diode rectification ratio $K = \frac{\Delta I_d}{\Delta I_r}$ при $/\Delta U_d/ = /\Delta U_r/$. weekend

For transistors, two characteristics are obtained: input, representing the functional dependence of current I_b on voltage U_{bE} ($I_b = f(U_{bE})$ at $U_k = const$ and the output, representing the functional dependence of the collector current I_k on its voltage U_k ($I_k = f(U_k)$) at $U_{bE} = const$. The main parameters are determined: input resistance $R_e = \frac{\Delta U_{bE}}{\Delta I_b}$ at $I_k = const$, output resistance $R_o = \frac{\Delta U_k}{\Delta I_k}$ at $I_b = const$, gain $K = \frac{\Delta I_{k_2}}{\Delta I_{k_1}}$.

Students, defining the specified parameters, get acquainted with methods that contribute to finding quantities that are not available in the experiment.

Laboratory work on the study of the parameters of the VAC characteristic of p-n and n-p-n junctions contributes to the strengthening of the professional orientation of a physical laboratory practice for students, in the specialties "Electromechanics and computer engineering", "Design and design of radio equipment", "Design of electronic computing equipment", "Electronic computer", "Industrial electronics"

Studies of some properties of fiber light guides

This work is devoted to the study of the operation of light guides. Fibers light guides used to transmit information in the light range of an electromagnetic wave, are used in various areas of the national economy: in optoelectronic calculating devices, in measuring technology, in electro-optical converters and brightness amplifiers, in high speed photography, in communication technology for the transmission of information, in medicine for visual observation of cavities inside the body, etc. [2]. With widespread use, it appears the need to study light guides and their inclusion in the manual for the physics practical work.

Light guides consist of a core and a cladding, which have different geometric shapes. Cores light guides serve to transfer information, and the shell protects against environmental influences and all kinds of contamination during long-term operation.

Along with this, the shell provides complete internal reflection of light into the core, since the refractive index of the cladding material is less than the refractive index of the core material [6].

Depending on the size and cross-section, the optical fibers are divided into two large groups:

a) light guides with cross-sectional dimensions much larger than the wavelength of light (multimode);

б) light guides with one or both of the cross-sectional dimensions comparable to the wavelength of light (single-mode).

Such division is due to the fact that in the first case, the propagation of light occurs approximately according to the laws of geometric optics and is represented as the passage of rays, obeying the laws of reflection refraction, whereas in the second case, the propagation of light through optical fibers should be considered from the point of view of the wave, electromagnetic theory of light, using the mathematical apparatus of Maxwell's equation.

In the above professional work character, light guides with large cross-sections are considered (multimode). The optical layout of the experiment is shown in Fig-4.

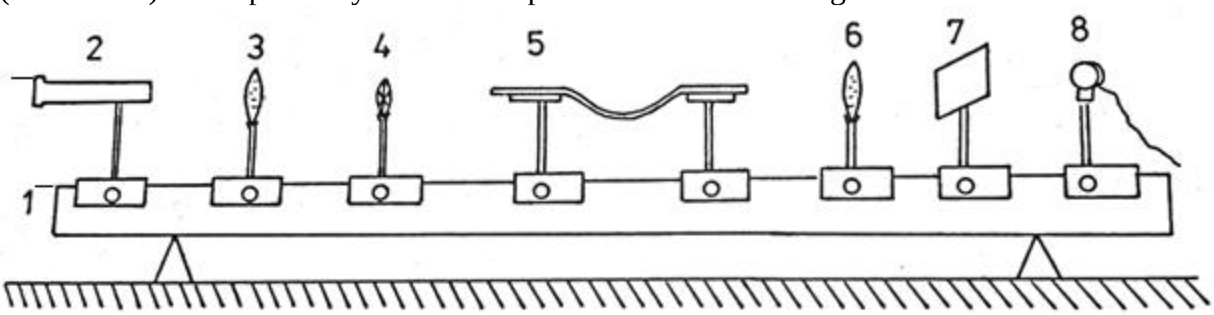


Fig-4. Optical layout.

The source of information in this experiment is an alternating light signal, obtained by focusing the laser beam 2, with the help of lens 3 and modulator 4.

This light signal, passing through a curved light guide 5 with different radii of curvature, hits the lens 6, which focuses the beam on the screen 7 or photodiode 8. Depending on the curvature of the light guide, the light intensity changes. It can be observed visually on a screen or measured with an oscilloscope connected through an amplifying system to a photodiode.

CONCLUSION

Physics laboratory practice, containing the performance of laboratory work of a creative and professional nature, contributes to improving the quality of mastering the course of general

ISSN 2056-5852

physics, development of creativity and professional outlook on learning, acquaintance with the latest achievements of science and technology, preparing a solid foundation for further mastering the course of general engineering and special disciplines studied in technical universities.

REFERENCES

1. Greisukh G.I., Sarantseva S.S. and other. Methodical instructions for laboratory work. - Penza, 2009 .- 16 p.
2. Kuchikyan L.M. Physical optics of fibers light guides –M .: Energy, 1979. - 191 p.
3. Kurbanov M. Theoretical basis for the expansion of the methodological functions of demonstration experiments in physics. Monograph. Tashkent, Fan, 2008, -118 p.
4. Landsberg G.S. Optics. - M .: Fizmatlit, 2003 .- 848 p.
5. Pasynkov V.V., Chirkin L.K. Semiconductor devices. - M., 2002 .- 480 p.
6. Sharupich L.S., Tugov N.M. Opto-electronics. - M., 1987.-256 p.