$$\mu_{lub=} I^{\circ}_{lub,1} \big/ I^{\circ}_{lub,2} \,;$$

$$\gamma_{lub} = f^{\circ}_{lub,1} \big/ f^{\circ}_{lub,2} \,;$$

$$\mu_{sol} = I^{\circ}_{sol,1} \big/ I^{\circ}_{sol,2} \,;$$

$$\gamma_{sol} = f^{\circ}_{sol,1} \big/ f^{\circ}_{sol,2} \,;$$

$$I_{lub,i} = \left[1 - (1 - \gamma_{lub})\mu^2_{lub}\big/(1+\gamma_{lub})(1+\mu_{lub})\right]I^{\circ}_{lub,i}\,;$$

$$I_{sol,i} = \left[1 - (1 - \gamma_{sol})\mu^2_{sol}\big/(1+\gamma_{sol})(1+\mu_{sol})\right]I^{\circ}_{sol,i}\,,$$

the value $\langle\alpha\rangle = (\alpha_1 I_{sol,1} + \alpha_2 I_{sol,2})\big/(I^{\circ}_{sol,1} + I^{\circ}_{sol,2})$ –

is the average concentration of the solid components into «third body» volume [6].

The relative synergic effects are may be presented by following relations:

$$\delta_i = 4\alpha^2_i (1-\alpha_i)\left[1 - k_i(1 - k_{n,i})\right] \cong 2\alpha^2_i (1 - \alpha_i)$$

(for the velocity of linear wear) and

$\langle\delta\rangle = 2 \langle\alpha\rangle^2 (1 - \langle\alpha\rangle)$ (for the friction coefficient).

It's need to note, this additive model of interacted «concentration waves» are may be used for prediction of CM tribologic properties in some systems [5, 7].

References

1. Ivanov V.V., Balakai V.I., Ivanov A.V., Arzumanova A.V. Synergism in composite electrolytic nickel-boron-fluoroplastic coatings // Rus. J. Appl. Chem. – 2006. – Т.79. – № 4. – С. 610–613.

2. Ivanov V.V., Balakai V.I., Kurnakova N.Yu. et al. Synergetic effect in nickel-teflon composite electrolytic coatings // Rus. J. Appl. Chem. – 2008. – Т. 81. – № 12. – С. 2169–2171.

3. Ivanov V.V., Shcherbakov I.N. Modeling of composite nickel-phosphorus coatings with anti-friction properties. – Rostov n/D Univ journal. «Math. universities. North-Caucasus. region». – 2008. – 112.

4. Balakai V.I., Ivanov V.V., Balakai I.V., Arzumanova A.V. Analysis of the phase disorder in electroplated nickel-boron coatings // Rus. J. Appl. Chem. – 2009. – Т. 82. – № 5. – С. 851–856.

5. Ivanov V.V., Shcherbakov I.N. Modelling the antifriction properties of homogeneous composite coatings on steel parts of friction based on the properties of the solid – body counter and lubricant. Math. universities. North- Caucasus. region. Tehn. science. – 2010. – № 5. – P.72–75.

6. Ivanov V.V., Shcherbakov I.N. Modelling the antifriction properties of homogeneous composite coatings on steel parts of friction, taking into account the properties of the solid components of the counter-body. Math. universities. North-Caucasus. region. Tehn. science. – 2010. – № 6. – P. 79–82.

7. Shcherbakov I.N., Ivanov V.V., Loginov V.T., etc. Chemical nanokonstruirovanie composite materials and coatings with anti-friction properties. Rostov n / D Univ journal. «Math. universities. North- Caucasus. region. Tehn. Science». – 2011. – 132 p.

RATIONAL TECHNOLOGICAL RESOURCE BASE AS MODEL OF INNOVATIVE DEVELOPMENT OF ENGINEERING EDUCATION

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The quality of modern engineering education (EE) is determined by fundamental training and aducation on the basis of the latest achievements of science. Imperative is creation of educational – scientific – production base (of technological resource base) training [1]. Technological resource base (TRB) is the basis for the formation of the technological subsystem of the university [2].

Conceptual positions on the formation of technological subsystems of system education of the university

1. *High importance of practical traning of the modern engineer.*

Distinctive feature of the present stage of development of EE is the increase in the importance of practical training of students. In structure of professional educational programs this kind of training has to make not less than 50-60 % from the general budget of time.

2. *Strengthening of technological resource base – the strategic direction of development of engineering education.*

According to the Federal Target Programme for the Development of Education for 2013–2020 gg an increase in funding for education is provided. Thus the greatest sum of money is aimed to EE development. The increase in expenses at EE is connected first of all with strengthening of technological resource base: updating of the equipment, creation of computer and multimedia audiences, acquisition of the modern software, development of telecommunications, etc.

Such attention of the state to EE is related with the economy country; its technical potential entirely depends on efficiency and quality of engineering education.

3. *Technological resource base – a factor of efficiency and quality of EE.*

The state quality system includes quality control, of execution of the federal state educational standards of higher education, which set out the requirements for equipment of laboratories, computer laboratories, multimedia audiences, as well as to the quality of educational training services using TRB. This attention to quality TRB by the monitoring system state indicates its special importance in the learning process, which reflects its the bond with the efficiency and the quality of the EE.

All this allows you to progect the structure of the technological subsystem: educational equipment, scientific equipment, learning resources

production, marketing center, service center and a center monitoring the quality of educational services and technologies.

The structure of subsystem is different in integrity and autonomy, all components are interconnected. The subsystem is connected with other subsystems, of the system of education of the university: pedagogical, financial – economic, scientific, production, system management.

The economic aspect of projecting of rational technological resource base

Financial contents of the subsystem, primarily the acquisition and buy of equipment requires the associated costs. At present procedure of replacement of the old equipment and purchase of the new one contains elements of stochastic character in university, not supported by objective indicators. Besides there is no system of indicators reflecting the bond between of the costs of training with TRB use, and the quality of educational services training of professional competencies Existence of such indicators solves a problem of an inefficient expenditure of the income of the university connected with acquisition and development of the new equipment. Furthermore, they allow to manage rationally (reasonably) the incomes at production of educational services training of professional competencies at each grade level of training. The offered economic aspect is directed to creation of rational TRB that is an innovative factor in EE development.

Projecting such a system, is advisable to perform on base a synergistic approach to the education system of the university [3]. The rational TRB is an innovation in self-organization of the education system of the university.

Bases of synergetic approach

It is important that educational services cover all levels of an education system for self-organization education system [4]. For example, educational services on training professional competencies are used in training in educational laboratories and scientific laboratories and work practice at manufacturing enterprises. All resources of educational services are used in these processes of training: humans (administration, professors, teachers etc.), information (educational the program, curricula, educational and methodical grants, textbooks, etc.) and materials (resource base, other means of technical support).

It is expedient to establish quality of educational services on the basis of results system multilevel economical – pedagogical monitoring. The system of indicators of resources of educational services is formed during level monitoring: educational (the first level), the scientific (the second level) and the production (the third level) on the resource base, during preparation stage. It is offered to consider educational process at three levels using the whole equipment at each level carrying out monitoring.

It is necessary for this research:

– to differentiate professional competences picking out professional-active component, his quality accord quality training with using TRB;

– to elaborate the cycle of quality of training professional competences on each equipment of each level is.

However according to FGOS these processes represent the uniform educational process student training in every direction training. The principles of systemacity and continuity must be carried out for this prosess. Performance of these principles is a link for three levels of training and promotes change of a qualitative condition system during its development.

Each level monitoring allows to introduce an element of organization in the education process using all the resource base of each level learning (initial stage complex system formation). However, the principles of systemacity and continuity must be executed in every direction training. Therefore the organization of the learning process at every level, will be directed also on the organization of the educational process learning professional-active component of the professional competences of whole direction of learning. Topologically correct organization of the subsystems leads to the time of exacerbation , the moment of maximum development of the system, of a synergistic effect. «Higher rates of development will be set in the whole domain . The whole develops its constituents. It is profitable to grow together, because this results in a saving of material , spiritual and other costs» [5]. It can be assumed that the attractor is a fundamentally new organization of training, the result of which is to improve the efficiency and quality of education.

Self-organization of a technological subsystem will promote dynamic balance of an economic subsystem, its self-organization with a steady trajectory of development which is defined by rational and effective use of the income university as a result of projecting of rational TRB of training.

However, if self-organization acts as the objective basis for activization of development of system, the organization is way of ordering of this initiative. Self-organization can lead to negative consequences therefore it needs adjustment and support from management parameters. Therefore the purpose of management is creation of conditions for the coordinated interaction of all resources of educational services of a technological subsystem, and also the coordinated interaction all subsystems, their functioning and existence as a whole, provided preservation and development of an education system of university, creating conditions for development of communicative communications between subsystems of an educational complex [6].

On the basis of monitoring researches it is expedient to develop economic-mathematical

model of TRB, as model of innovative development of EE.

Application of information technologies will allow to create an automated control system that is directed on improvement of quality and efficiency of EE and at a rational expenditure of the income of university.

References

1. Tarasova M. And. Engineering education. Condition and development of educational and research and production base: monograph. – Orel: FGBOU VPO «State University-UNPK», 2013. – 227 p.

2. Tarasova M.A. Synergetic effect at monitoring researches of an education system of Higher education institution / M.A. Tarasova, V.V. Vlasov // Information systems and technologies – the scientific and technical magazine. – March-April 2013. – № 2 (76). – P. 49–58.

3. Solodova E.A. Novye models in an education system: Synergetic approach: Manual / Predisl. G.G. Malenitsky. № 56; № 15. Izd. Stereotip. – M.: Book house of «Librokom», 2013. – 344 p.

4. Batalova O.S. Spetsifika of educational service as basis of marketing policy of higher education institution of the // Topical issues of economy and management: materials scient. conf. (Moscow, April, 2011). T. II. – M.: RIOR, 2011. – P. 7–12.

5. Prigozhin I. Vvedeniye in thermodynamics of irreversible processes / Under N.S. Akulov's edition; V.V. Mikhaylov Lane. – 2-nd prod. – M.: Izhevsk: Scientific Center «Regulyarnaya i haoticheskaya dinamika», 2001. – 160 p.

6. Shamova T.I. Upravleniye educational systems: studies / T.I. Shamova, T.M. Davydenko, G.N. Shibanova; under the editorship of T.I. Shamova. – 3-rd prod. I erased. – M.: Izdat. Akademiya center, 2006. – 384 p.