

**RATING TEACHERS AND STRUCTURAL DIVISIONS
OF NATIONAL UNIVERSITY OF LIFE AND ENVIRONMENTAL
SCIENCES OF UKRAINE (NULES)**

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In paper the questions of application of rating the quality of professional work of teachers, departments and faculties of the university. The author offers specific examples scientifically based and original model for calculating the ranking of subjects of scientific and educational activities of the university and its structural divisions. This article can serve as a methodological guide for the development and implementation of the activities of the rating evaluation of the quality of the teaching staff.

It is recommended that managers and professionals involved in the problems of quality assessment in higher vocational education.

Rate, teacher, teaching load, standards, types of work, rates, wages, base salary, motivation.

Rating determination of research and educational workers, structural divisions and an institution of higher education as a whole is a complicated and very important problem. The National Agrarian University for example is the IV accreditation level institution of higher education, it contains following 8 educational and research institutes (ERI):

- natural and humanitarian;
- plant growing, soil science and ecology;
- animal breeding and water biological resources;
- veterinary medicine, quality and safety of products manufactured in agrarian-industrial complex;
- business;
- technical
- forestry and landscape-gardening;
- land resources, science of law and pedagogics.

There are also the institute of postgraduate education and the military faculty.

There are 128 sub-faculties in above-mentioned ERIs, they are united into 30 educational and research centers (ERC) in accordance with their profiles. Task-level and research laboratories earlier dispersed are united into 7 research institutes (RI) being parts of ERIs. 18 faculties are parts of the NULES's ERIs, where the training in 15 specialties and

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40 specializations are carried out. Regional Berezhansk and Nizhyn Agricultural Engineering Institutes (III accreditation level) as well as Irpin, Zalischiky, Nemishaievo Agrarian Colleges and Boyarka Agricultural Secondary School are structural divisions of the NULES. The training is executed according to the following educational and skill levels: bachelor, specialist and master. The training's forms are: internal training, instruction by correspondence, education with examinations without attending lectures and distance studies.

The method of rating estimation for acting subjects developed in the NULES (by Ass. Prof. A.V. Shostak) permits to estimate the quality of teaching-educational process with the help of quantitative indexes (criteria). *It permits not only to estimate, but to optimize process' organization, improve the management and labor motivation, determine the place of given educational institute among institutes of the same profile in any field of education. This is the main aim of the developed method.* Unfortunately, the work quality of structural divisions as well as single workers can be formalized not always. As for the teaching staff, the estimation criteria for their work results are based on provision "On planning and taking into account of the loan of research and educational workers of the NULES", are consistent with the NULES's Statute and job descriptions.

At the same time the main drawback of all known methods is the fact that aspiring to the objectivity and maximum consideration of various factors, developers are creating excessively cumbersome and inconvenient methods overburdened by large quantity of questionnaires, forms, rating-lists, formulas and other accompanying documentation. This always arouses an inner protest and aversion from the direction of direct performers: *to estimate any work according to such criteria is more difficult than to perform the work itself. Such methods already do not service any basic activity for its optimizing but themselves are separate kind of activity.* But the following question is arising: Who needs it and why?

The method developed and realized in the NULES had passed good and frequentative expertise, and has solid normative and lawful foundations. We have deviated from the system based on a count of cores, what is the base of almost all existing methods.

Our method is unique in Ukraine today and permits to formalize the teaching-scientific-educational process in an institute of higher education to the maximum, and at the same time it is sufficiently *objective and easy used as well as its results have single meaning.*

Problem definition. Tasks, with which higher agrarian educational institutes face under present-day close economical and socio-political conditions, require not only structural and management changes, but the

improvement of the quality of educational process: to overcome ingrained stereotypes and introduce recommendation of agrarian-pedagogical science into teaching activity. What is the heart of the problem?

Firstly, accepting and mastering new pedagogical ideas and educational technologies of their application by the teaching staff as well as generalizing huge existing experience (both native and foreign) of introducing agrarian-pedagogical science in practice.

Secondary, passing from spontaneous and *weakly controlled* application of major achievements agrarian-pedagogical science by the teaching staff to introduction of its recommendations as a *controlled process*. The rating is the serious instruments of this process.

The stated problem has taken on special urgency in connection with entering the National Agrarian University into the Global Consortium of Institutions of Higher Agrarian Education and Researches in Rural Economy. Rector of the National University of Life and Environmental Sciences of Ukraine, Academician of the Russian Academy of Education S.M. Nikolayenko set a goal to develop a mythology that should motivate of research and educational workers.

Kinds of activity and effectiveness criteria for teaching work. As it was mentioned the humanitarian nature of teaching-educational and scientific activity is influenced the formalization very difficulty. The developed method allows to represent quality criteria of such activity by means quantitative indexes (coefficients). It is known that in these latter days the method of educational process estimation was being reduced to the level of qualitative criteria research. The research of quantitative estimation criteria for different aspects of scientific-teaching-educational process, which gives objective information on advantages and disadvantages of educational institute's activity, is the necessity prerequisite for improving its work. Therefore we will attempt to see and derive some quantitative indexes (criteria) through the prism of qualitative indexes. In other words, we will attempt to formalize the humanitarian activity with the purpose to estimate objectively the working efficiency of the institute of higher education, its divisions and individual instructors.

In accordance with provision* "On planning and taking into account of the loan of research and educational workers of the NULES" approved by the rector, the budget share of salary consists of remuneration for 5 kinds of works, namely: educational, research, introduction, methodological, and cultural and educational. The same concerns also the individual plan of an instructor, for whose fulfillment he or she shall give a report at the end of the year. The annual time budget of a research and educational worker (REW) is equal to 1,548 hours (258 6-

hour working days). As it is known, all things shall be cognized in the comparison: the ratio of quality, which we have, to the quality, which we would like to have (normative). The numerical determinant of this ratio is *a coefficient*. And so *the essence of the method is reduced to determine coefficients, what describes the teaching-scientific-educational process and its subjects*. With this purpose the following quantitative indexes or basic criteria for the scientific-teaching-educational process are proposed:

Coefficient of teaching work fulfillment:

$$K_{tch} = \frac{\sum_{i=1}^n t_s}{T_{tch}}, \quad (1)$$

where: **i** is the kind of fulfilled teaching work; **n** is the number of teaching work kinds (can be changed every year); Σ is the sum of all kinds of fulfilled teaching work; t_s is the standard time necessary to fulfill the separate teaching work, hours; T_{tch} is the planned (budget) share of the teaching work, which shall be fulfilled by the instructor during the *academic year*, hours (at the present time it is equal to 900 hours, 58 % of 1548 hours).

Coefficient of scientific work fulfillment:

$$K_{sci} = \frac{\sum_{i=1}^n t_s}{T_{sci}}, \quad (2)$$

where: **i** is the kind (name) of fulfilled scientific work; **n** is the number of scientific work kinds (can be changed periodically); Σ is the sum of all kinds of fulfilled scientific work; t_s is the standard time necessary to fulfill the separate scientific work, hours; T_{sci} is the planned (budget) share of the scientific work, which shall be fulfilled by the instructor during the *calendar year*, hours (at the present time it is equal to 200 hours, 13 % of 1548 hours).

Coefficient of introduction of the achievements of scientific and technological progress to production:

$$K_{intr} = \frac{\sum_{i=1}^n t_s}{T_{intr}}, \quad (3)$$

where: **i** is the kind (name) of fulfilled introduction work; **n** is the number of introduction work kinds, work concerning introduction of state budget and contract scientific developments to production (can be changed every year); Σ is the sum of all kinds of fulfilled introduction work; t_s is

the standard time necessary to fulfill the separate introduction work, hours; T_{intr} is the planned (budget) share of the application work, which shall be fulfilled by the instructor during the *calendar* year, hours (at the present time it is equal to 140 hours, 9 % of 1548 hours).

Coefficient of scientific-methodical work fulfillment:

$$K_{sm} = \frac{\sum_{i=1}^n t_s}{T_{sm}}, \quad (4)$$

where: i is the kind (name) of fulfilled scientific-methodical work; n is the number of fulfilled scientific-methodical work kinds (depending on put problem can be changed every year); Σ is the sum of all kinds of fulfilled scientific-methodical work; t_s is the standard time necessary to fulfill the separate scientific-methodical work, hours; T_{sm} is the planned (budget) share of the scientific-methodical work, which shall be fulfilled by the instructor during the *academic* year, hours (at the present time it is equal to 170 hours, 11 % of 1548 hours).

Coefficient of cultural and educational work fulfillment:

$$K_{ce} = \frac{\sum_{i=1}^n t_s}{T_{ce}}, \quad (5)$$

where: i is the kind (name) of fulfilled cultural and educational work; n is the number of fulfilled cultural and educational work kinds (depending on present-day requirement can be changed every year); Σ is the sum of all kinds of fulfilled cultural and educational work; t_s is the standard time necessary to fulfill the separate cultural and educational work, hours; T_{ce} is the planned (budget) share of the scientific-methodical work, which shall be fulfilled by the instructor during the *academic* year, hours (at the present time it is equal to 138 hours, 9 % of 1548 hours).

The increase or decrease of the weight of every of 5 load kinds is provided for by provision "On planning and taking into account of the loan of research and educational workers of the NULES", but the total load summed through all kinds of activity shall be no less than 1548 hours, i.e. shall be equal to the annual time budget. For example an instructor successfully fulfills scientific work, introduces its results and reports soundly assuming on 700 hours instead of 200 and 140 hours, respectively. In that case the sub-faculty shall decrease his or her load by corresponding quantity of hours of other activity kinds. As the general estimation criterion for instructor's activity during a year *the general coefficient* (K_{gen}), which is the ratio of sum of all kinds of fulfilled work (hours) to the standard (planned) one:

$$K_{gen} = \frac{T_{tch} + T_{sci} + T_{intr} + T_{sm} + T_{ce} + T_{oth}}{T_s} \geq 1 \leq 2 \quad (6)$$

This coefficient corresponds exactly the degree of fulfillment and overfulfillment of the planned load by a research and educational worker, it falls in the range from 80 % ($K_{gen} = 1.00$, i.e. total annual load is equal to 1548 hours) to 100 % ($K_{gen} = 2.00$, i.e. total annual load is equal to 3096 hours) of higher salary of such post. When $K_{gen} < 1$ (i.e. less than 1548 hours is fulfilled) the well-reasoned explanation shall be submitted into the office of the head of studies of the institute.

Fig. 1 shows the geometrical interpretation of set forth method. Of course, shown *limits and volume* of the activity kinds have enough relative, reference character. In essence, they are norms. In reality the weight of each activity kinds can change, what is reflected in individual plans of instructors.

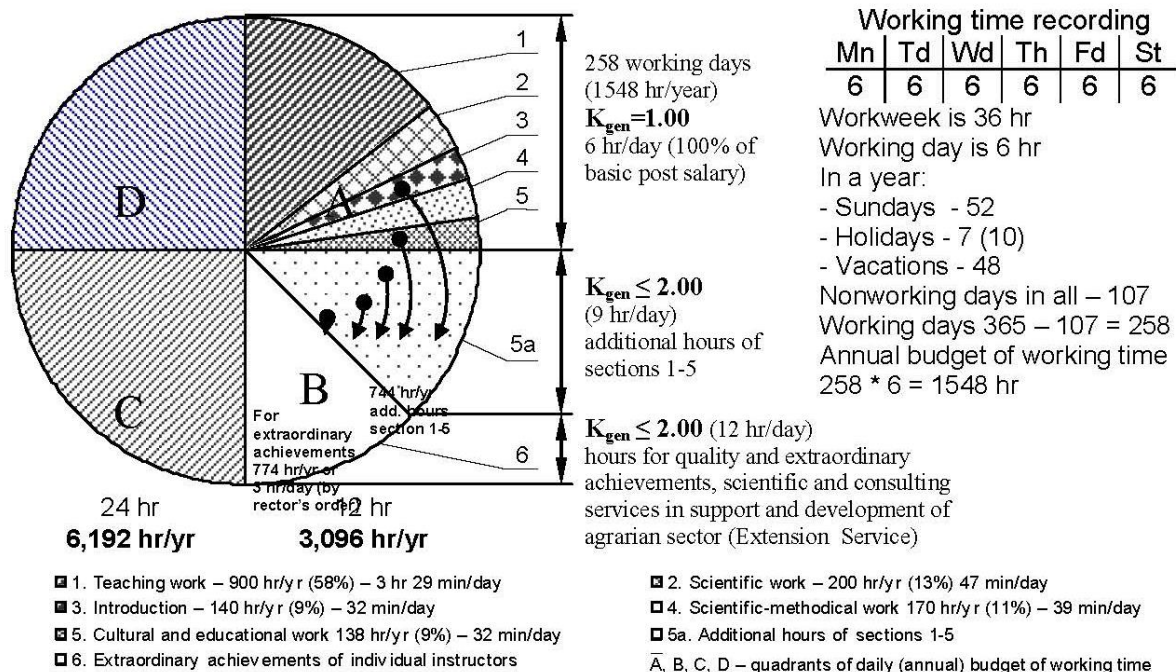


Fig. 1. Standard time calculation according to work kinds for REWs of the NULES.

The list of main activity kinds of research and educational workers of the NULES together with components of their salary is shown in Fig. 2 (see also quadrant A in Fig. 1, when K_{gen} is 1.00).

Generalization of results. Annual estimation of results of teaching staff's and structural divisions' activity have conducted in the NULES from 1997. From 2001 the diversified remuneration of labor are paid within the limits of 20 % of higher salary in accordance with individual coefficients. It shall be noted that only 11.6 % REWs of the NULES have

$K_{gen} = 1.75-2.00$. And only 5 % of members of the staff have maximum value, $K_{gen} = 2.00$ (see Fig. 3). It is not the result of steep demands but the result of objective approach to estimating the teaching labor. Considering the fact that the committee created specially has to work thoroughly with original (primary) materials incoming from sub-faculty, since a temptation can arise to submit overstated and data not confirmed by documents.

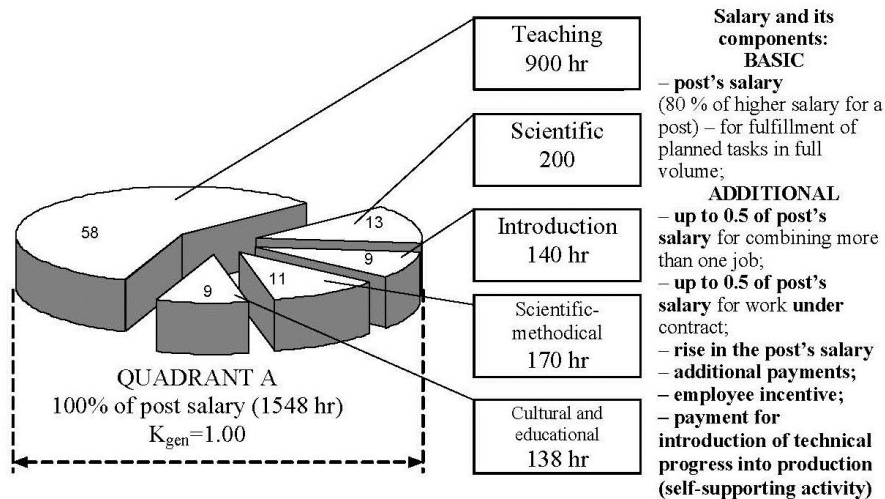


Fig. 2. List of basic activity kinds and components of salary of REWs of the NULES.

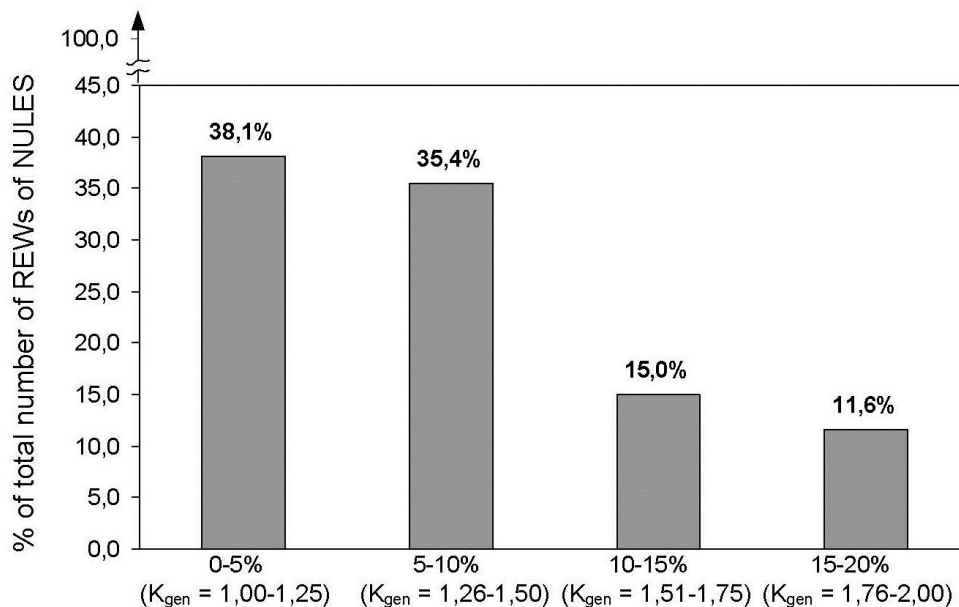


Fig 3. Distribution histogram for increase of post salaries of research and educational workers of NULES according to rating results for the year of 2012.

The system stimulates such activity kinds, which overstep the limits of direct functional duties listened in job descriptions. Every year,

estimation of results of all activity kinds is carried out before December 25.

The activity of sub-faculties having $K_{gen} < 1.00$ is subjected to comprehensive analysis. Causes are determined, necessary methodical and material aid is granted, weaknesses are pointed, organizational decisions are reached as well as other measurements concerning reinforcement and stabilization of their work are taken. Similar approach is used as for the teaching staff.

The ratings of ERI' of the NULES obtained according to general coefficient K_{gen} for the year 2012 are shown in Fig. 4. To analyze the situation, similar histograms was drafted for each kind of activity with taking into account all coefficients: K_{tch} , K_{sc} , K_{intr} , K_{sm} , K_{ce} and K_{oth} .

In case the rating committee detects any false additions, a respective instructor (sub-faculty) shall be displaced from the rating process, i.e. he or she will have $K_{gen} = 1.00$.

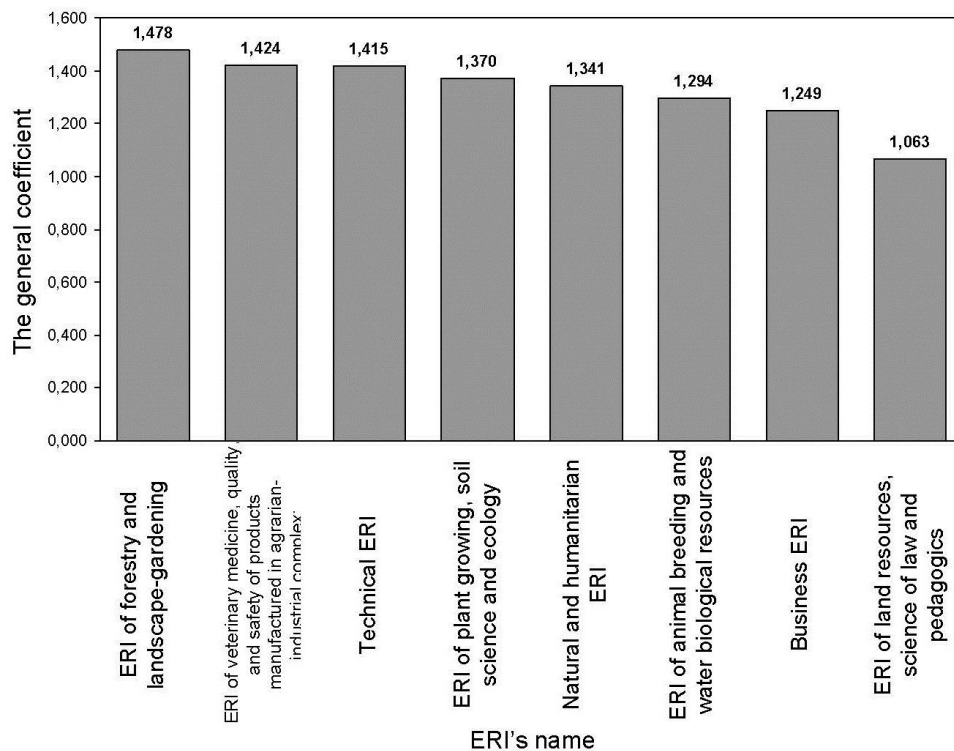


Fig. 4. General ratings of ERIs of the NULES for the year of 2012 (according to the generalized coefficient).

The questions of activity estimation and stimulation have been solved not only for member of the staff, but for persons, who hold more than one office. It concerns all such persons both those, whose main office is in the NULES, and those, who are workers of other establishments, institution, companies and so on, including the foreign ones. The maintenance staff of the sub-faculties also was not forgotten

(laboratory managers, teaching masters, methodologists and others): additional salary payments to them were made in accordance with the rating of respective sub-faculty. The *separate* method was developed for activity estimation and rating determination of members of staffs of research institutes; there are 7 such institutes in the NULES. But this is not the subjects of this paper.

When the method of activity estimation for instructors and structural divisions was created, the question on *its adaptation to the specific* of several sub-faculties was solved. The activity of colleagues connected with taking out patents and inventor's certificates for example are typical only for sub-faculties of technical profile. And inclusion of similar index in evaluation method for humanitarian profile sub-faculties such as sub-faculties of Ukrainian, German and French languages, philosophy, culture science and other seems dubious. The necessity to *formalize* the evaluation methods is one more aspect of its adaptation. With that purpose the software support for above method was developed (under the direction of Prof. I. I. Melnyk), which permits to realize the rating calculation scheme in the form suitable for data processing by an application program and storage in a database. The editing program of rating calculation schemes permits to "assemble" or modify it by the direct-manipulation method: to move the work index into the integral index and move integral indexes into indexes corresponding to activity kinds. A number of technical problems were detected, which were connected with the necessity to create comfort environment for a user, and which shall be solved in the course of *preparation to the system to replication of code*. In order that the program can work, *Windows 95/98/2000/* and professional version of *Microsoft Office* containing *Access 97/2000* and all other latest versions of its which shall be installed on the computer.

Outlook of system's implementation. In accordance with Article 58 of Law of Ukraine "On education" and Provision "On measures of winners' incentive", the rating estimation of activity of the NULES' staff permits to apply various forms of incentives to such REWs and managers of divisions, who will occupy higher rating places: to be recommended for awards of the President of Ukraine – orders or decorations, to receive honorary titles; to be granted scientific ranks, promotion, awarding prizes, additions to salary, to be awarded by diplomas, prolonging the contract for the next period and other kinds of material and moral incitements. It is effective instrument for the manager, who has *direct feedback* with every of subjects of the university's activity. The developed system can completely adapted to estimate activities of other universities in other field.

Conclusion. So, which criterion shall the set forth method satisfy?

Criterion 1. Simplicity of setting forth. The methods is understandable, many times approved, accepted by performers, executed at enough high level, has references and is based on the experience of predecessors and colleagues. There are “through” recommendations and the limits of its application are marked from the problem’s definition to its solution.

Criterion 2. Novelty of method. In this case the “novelty” of method is understood both as the non-evidence of its recommendation to a specialist and as the complexity of solved problems. The novelty at *emotional* level “shakes” and shows new points of view on known events. The presence of the novelty at *methodical* level is evident, it enable to foresee estimated phenomena.

Criterion 3. Instrumentality of methods. The method is not reduced to emotional appeals and nonconstructive criticism of analogues. A number of real-world problems already have been solved in the NULES. It would be difficult to solve them without this method. This is very important fact that the method can work not only in “author’s performance”. It is more effective than other known methods and contains warnings about typical errors of a user, who works with it. The method permits to set problems and obtain one or several interconnected solutions, which are not obvious for a user without the method’s help, i.e. the method is *practically feasible*.

Criterion 4. Expenses of users connected with method. To use efficiently the method, it is necessary to spend some additional time and means, author’s consultations are necessary too. After explaining actually all instructors have mastered minimally the method.

Criterion 5. Aims of authors (auxiliary criterion). The authors were not impelled by the wish to satisfy their vainglory or receive money. The stimulus consisted in the wish and ability to hand over the development to colleagues at worthy scientific level with the purpose to continue investigations and solutions of new problems as well as to use the method as instrument to create a new generation method with coming at independent creative level.

Moreover. The method assists the idea to conduct sufficient decentralization, i.e. to devolve separate operating levers of money flow and main kinds of activity to lower management levels, which provide decision making, and more professional execution of some decisions.

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У статті розкриваються прикладні питання рейтингової оцінки якості професійної діяльності викладачів, кафедр і факультетів вузу. Автор на конкретних прикладах пропонує науково обґрунтовану і оригінальну модель розрахунку рейтингу суб'єктів науково-педагогічної діяльності університету та його структурних підрозділів. Дана стаття може служити в якості методичного посібника з розробки та впровадження системи рейтингового оцінювання якості діяльності професорсько-викладацького складу. Рекомендується керівникам та фахівцям, які займаються проблемами оцінки якості в системі вищої професійної освіти.

Рейтинг, викладач, педагогічне навантаження, нормативи, види робіт, коефіцієнти, заробітна плата, базовий посадовий оклад, мотивація

В статье раскрываются прикладные вопросы рейтинговой оценки качества профессиональной деятельности преподавателей, кафедр и факультетов вуза. Автор на конкретных примерах предлагает научно обоснованную и оригинальную модель расчета рейтинга субъектов научно-педагогической деятельности университета и его структурных подразделений. Данная статья может служить в качестве методического пособия по разработ-

ке и внедрению системы рейтингового оценивания качества деятельности профессорско-преподавательского состава. Рекомендуется руководителям и специалистам, занимающимся проблемами оценки качества в системе высшего профессионального образования.

Рейтинг, преподаватель, педагогическая нагрузка, нормативы, виды работ, коэффициенты, заработная плата, базовый должностной оклад, мотивация

УДК 62-192÷621

ПОБУДОВА МОДЕЛЕЙ І ПРОГНОЗУВАННЯ МЕХАНІЧНОЇ НАДІЙНОСТІ ПРИ ДЕГРАДАЦІЙНИХ ВІДМОВАХ

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Розглянуто загальний підхід до вирішення проблеми побудови інвертуємих стохастичних моделей механічної надійності у випадку параметричних деградаційних відмов. Запропоновані методи ілюструються реальним прикладом прогнозування довговічності при зношуванні.

Деградаційна відмова, прогнозування надійності, стохастична модель.

Постановка проблеми. Параметричні деградаційні відмови, які проявляються в процесі експлуатації мобільних машин, в основному відносяться до категорії часткових, тобто таких, які відразу після виникнення не призводять до неможливості функціонування об'єкта, але порушують його працездатність. Прикладами параметричних відмов у машинах є різні розрегулювання, ослаблення затягування різьбових з'єднань; численні відмови, обумовлені зношуванням сполучень та ін. Кожнатака відмова пов'язана з виходом одного або декількох параметрів стану об'єкта за межі, встановлені нормативно-технічною документацією. У силу специфіки параметричних відмов при зазвичай використовуваному в практиці прискореної оцінки надійності дискретному контролі параметрів точно зафіксувати моменти їх виходу на граничний рівень, як правило, не вдається. Крім того, при широко поширеному способі збору інформації методом одноразових обстежень партії машин в експлуатації і, особливо

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