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Criteria for Professional Accreditation of Engineering Programs of Secondary and Higher Vocational Education

A.I. Chuchalin

E.Yu. Yatkina

G.A. Tsoi

P.S. *Shamritskaya*

National Research Tomsk Polytechnic University
A.I. Chuchalin, E.Yu. Yatkina,
G.A. Tsoi, P.S. Shamritskaya

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The new draft version of criteria for professional accreditation of engineering programs of secondary and higher vocational education is given in the paper. The criteria meet the requirements of new Federal Law "On Education in the Russian Federation" (№273-FZ) and correspond to the international standards such as EUR-ACE Framework Standards for Accreditation of Engineering Programmes and IEA Graduate Attributes and Professional Competences.

Development of professional public accreditation

In the last ten years Association for Engineering Education of Russia (AEER) has been successfully developing internationally integrated national system for professional accreditation of engineering programs of higher vocational education.

The evaluation criteria were developed in 2002 by AEER experts based on the best traditions of the national higher education and international experience of engineering education quality assurance. The following AEER structural elements as the Accreditation Centre and the Accreditation Board were founded. The AEER Accreditation Board consists of reputable repre-sentatives of academia, science, industry and professional organizations [1].

In 2003 AEER signed cooperation agreement with the Ministry of Education of Russian Fed-eration on the development of national system of professional accreditation of engineering and technology educational programs, in 2005 – cooperation agreement with the Federal Edu-cation and Science Supervision Service (Rosobrnadzor). In 2003 first 12 educational programs from 6 leading engineering universities of Russia were accredited following the AEER evaluation criteria corresponding international standards.

Over the last decade AEER has continuously improved the accreditation criteria and proce-dure, widening cooperation with state authorities responsible for the education system gov-ernance, public and professional associations and alliances, industry representatives, foreign and international organizations which main activities are focused on the field of engineering education quality assurance. The number of accredited by AEER educational programs of Russian universities has also increased [1 -3].

During 2003-2013 period AEER concluded several agreements on independent external evaluation and professional accreditation of engineering educational programs with Chamber of Commerce and Industry of the Russian Federation (CCI), the Academy of Engineering Sciences (AES), Russian Union of Scientific and Engineering Associations (RUSEA), strengthened collaboration contacts with Russian Academy of Sciences (RAS), Russian Un-ion of Industrialists and Entrepreneurs, Agency of strategic initiatives and other organizations interested in development and improvement of engineering education in our country.

In 2004-2006 period AEER took an active part in running international project aimed at defi-nition of EUR-ACE Framework Standards for Accreditation of Engineering

Pro-grammes and development of European engineering programs accreditation system consistent with the whole Bologna Process. From 2006 AEER represents Russia in European Network for Accreditation of Engineering Education (ENAEE) along with public and professional or-ganizations from the United Kingdom (ECUK), France (CTI), Germany (ASIIN) and other countries, and is authorized to award a common European quality label (EUR-ACE Label) [4]. In 2008 AEER facilitated membership of RUSEA in Federation Europeenne d'Associations Nationales d'Ingenieurs (FEANI) [5].

In 2003-2007 period AEER enhanced cooperation with national agencies for engineer-ing programs accreditation – signatories of the Washington Accord such as ABET in USA, CEAB in Canada, JABEE in Japan and others. In 2007 AEER became provisional member and in 2012 became full member of the Washington Accord, the world's most authoritative organization in the field of evaluation and quality assurance of engineering education [6].

From 2010 AEER represents Russia in APEC Engineers Agreement, agreement on certification and registration of APEC Professional engineers, and in 2013 AEER was accept-ed as a Provisional Member to the International Professional Engineers Agreement (IPEA) – international organization that certifies and registers professional engineers globally.

Thus, over the last ten years, the Association for Engineering Education of Russia, to-gether with other stakeholders in the country established a national system of professional public accreditation in engineering education, which received international recognition, and started work on development national system for certification and registration of professional engineers. Currently, 220 educational programs of higher vocational education in the field of engineering and technology in universities of Russia and Kazakhstan were accredited by AEER. Most accredited programs were included in the international registers of ENAEE and FEANI [4,5]. More than 200 engineers from Russia and Kazakhstan took part in the pilot pro-ject for certification of engineering qualifications in accordance with international standards. About 80 engineers have successfully completed the certification process and are registered in the APEC Engineers Register [6].

New objectives and perspectives of professional accreditation

On September 1, 2013 the new Federal Law "On Education in the Russian Federation" (№ 273-FZ) will come into force. Following the new law (art. 96), "employers and their asso-ciations, as well as authorized by them organizations may carry out professional public-accreditation of educational programs delivered by the organization providing educational ac-tivities".

The new law defines professional public accreditation of vocational educational programs as "recognition of the quality and level of training of graduates who have graduated such an edu-cational program in a particular organization, carrying out educational activities that meet the requirements of professional standards, the requirements of the labor market for specialists, qualified workers and employees of the relevant profile". At the same time "data on the results of public or professional public accreditation that have an organization, carrying out ed-ucational activities, should be submitted to the accreditation body and are considered within the process of state accreditation".

Due to the fact that new Federal Law "On Education in the Russian Federation" will soon come into force AEER together with the Russian Ministry of Education, Rosobrnadzor, Rus-sian Union of Industrialists and Entrepreneurs and other stakeholders is involved in the devel-opment of new regulatory framework to carry out professional public accreditation regulating the interaction between state educational authorities, employers and authorized organizations. At the same time AEER updated accreditation criteria and procedure, taking into account the perspectives of engineering education development in Russia, the expansion of international recognition and credibility of training and qualifications of graduates of Russian educational institutions [3,7].

It was a new task for AEER to develop criteria for assessing the quality of applied bachelor programs and secondary vocational educational programs in the field of engineering and technology. Elaborated criteria correspond to the evaluation criteria for assessing the quality of academic bachelor programs, specialist and master degree programs, as well as the stand-ards of the International Engineering Alliance (IEA Graduate Attributes and Professional Competences) and the European Network for Accreditation of Engineering Education (EUR-ACE Framework Standards for Accreditation of Engineering Programmes) [4,6].

New professional accreditation criteria

New AEER accreditation criteria for degree engineering programs of secondary and higher vocational education are grouped as follows:

1. Program objectives and learning outcomes.
2. Program content.
3. Students and educational process.
4. Faculty.
5. Professional qualifications.
6. Program resources.
7. Graduates.

The criteria provide a common approach to professional public accreditation of educa-tional programs at various levels, which stimulates the coherence and continuity of educational programs for the creation of unified engineering education area that meets international practice [7].

The criteria are designed to evaluate quality of training of graduates from degree engineering programs of secondary and higher vocational education and validate that they are prepared for engineering practice, as well as to the applied, complex and innovative engineering activi-ties at the level meeting the requirements of professional standards, labor market and interna-tional requirements for the competence of engineering

technicians, engineering technologists and professional engineers. The compliance with the criteria shall guarantee the quality of training and promote ongoing improvement of engineering programs.

Complex engineering activity is complex and multi-component. It includes planning, design, production and application of technical objects, systems and processes, covering a wide range of engineering, technical and other issues. Complex engineering problems associ-ated with the research, analysis and design of engineering products, systems and processes involve the use of basic knowledge of mathematics, natural sciences, engineering fundamen-tals and other sciences corresponding to area or specialty of training, as well as in-depth or specialized knowledge, including multi-disciplinary knowledge relevant to the profile or spe-cialization.

Training for complex engineering activity can be carried on the basis of academic bachelor or specialist degree programs of higher vocational education. The programs can be focused on experimental research, design, production and technological, organizational, managerial, and (or) other activities.

Innovative engineering activity could be considered as the next stage and development of complex engineering activity and is aimed at the development and creation of new techniques and technologies for new social and (or) economic impact, and therefore particularly competitive. Innovative engineering activity is multi-level and multi-disciplinary, it is based on in-depth fundamental and applied knowledge, analysis and synthesis of the characteristics of engineering products, systems and processes with the help of mathematical models of high level.

It is crucial for the innovative engineering activity the ability to design and conduct complex multivariate experiment, interpret data and draw conclusions in terms of ambiguity using in-depth knowledge and original methods to achieve the desired results. Another important element is an experience in design of engineering products, systems and processes including awareness of economic, environmental, social and other constraints.

Training for innovative engineering activity is based on master degree programs of higher vocational education. The profiles of educational programs could include research, design, production and technological, organizational, managerial, and (or) other activities.

Applied engineering activity is focused on the efficient use of engineering products, systems and processes, the development of advanced manufacturing technologies, new forms and methods of work organization. Applied engineering activity requires training in the field of active methods of technological development of production, balance of basic knowledge and practice-oriented competencies.

Training for applied engineering activity is based on applied bachelor degree programs of higher vocational education. Programs should provide practice-oriented training typical for secondary vocational education, and theoretical training typical for higher education programs at the bachelor's level. As a rule applied programs in engineering and technology are profiled on the production and technological activity.

Engineering technology practice is focused on technical assistance to engineering design, manufacturing, testing and operation of engineering products, systems and processes. The main objects of professional activity of engineering technicians is technical and technological equipment, and their main tasks are connected with its setup, maintenance, service and repair, etc.

Engineering technology practice is related to the installation and operation of equipment, tools and

other components of engineering products, systems and processes. The solution of practical technical problems involves routine tasks, work with directories, measurements and other activities with the use of existing and well-known techniques and protocols. Training for engineering technology practice is based on training programs of secondary vocational education.

The following AEER criteria are based on program objectives and learning outcomes that outline general competencies (transferable skills) and professional (general and specific) competencies to be acquired by students upon completion of an engineering educational pro-gram.

The program can be accredited only if the achievement of learning outcomes by all the students is verified and the graduates are prepared for engineering practice in accordance with program objectives.

The program objectives are formulated by higher education institution (HEI) and should correspond with the institution mission. Learning outcomes are based on the program objectives and must meet the requirements of employers and other interested parties. The pro-gram objectives as well as learning outcomes of the program introduced for accreditation must be in full correspondence with the Federal State Educational Standard of the Russian Federation or HEI standard, and AEER criteria.

According to AEER accreditation procedure only licensed programs with state accred-itation are accepted for evaluation.

In order to be accredited a program must meet all of the criteria given below. The cri-teria establish different levels of compliance with the stipulated conditions:

- «must», «necessary» are used to specify the obligatory requirement for accrediting an engineering program;
- «recommended» means that the accomplishment of the requirement is recommended for accrediting an engineering program;
- «important consideration» means that the accomplishment of the requirement would be advantageous for accreditation but is not mandatory;
- «may» is used for offering alternative ways of meeting the criterion.

1. Program objectives and learning outcomes

Each engineering program must have clearly stated and documented objectives that are in full correspondence with the Federal State Educational Standard, HEI standard and the institution mission. Program objectives must be published and available for all interested parties as well as shared by each faculty member participating in program delivery.

Learning outcomes the educational program must be consistent with its objectives, to be documented and clearly expressed in terms of the level of graduates' competence that meet the requirements of AEER Criterion 5, the Federal State Educational Standard, HEI standard relevant to the specialization or profile of training.

There must be an effective system for achieving and adjusting objectives and learning outcomes. The data obtained by means of this system should be used to improve the curricu-lum and the training process.

Particular attention should be paid to the fact that program objectives and learning outcomes must meet the requirements of professional standards, the needs of the labor market and the needs of potential employers. Therefore, it is recommended to involve industry repre-sentatives in the process of developing and improving educational programs.

2. Program content

In accordance with the requirements of the Federal State Educational Standards con-tent of educational programs is evaluated in credits – European Credit Transfer System (ECTS), recommended in the framework of the Bologna process. The bachelor program must be of at least 240 ECTS credits, specialist program – at least 300 ECTS credits, master program - at least 120 ECTS credits.

The program and syllabus for each course must include disciplines and interdisciplinary modules consistent with the program objectives. They should ensure the achievement of general (transferable skills) and professional competences by all the graduates, as well as practical experience in specific field of activity relevant to the awarded qualification.

The curriculum must include scientific, mathematical, humanitarian, socio-economic and professional disciplines, as well as interdisciplinary modules and practice (R&D). The amount of the natural sciences and mathematical disciplines in a practice-oriented training within applied bachelor programs is recommended to be of at least 30 ECTS credits, academic bachelor and specialist programs - must be of at least 60 ECTS credits. In master programs recommended amount of in-depth scientific and mathematical disciplines –12-15 ECTS credits. The recommended amount of humanitarian and socio-economic disciplines in academic bachelor and specialist – 20-30 ECTS credits.

Professional disciplines and interdisciplinary modules must ensure that graduates are prepared to practical engineering activity in accordance with the objectives of the educational program. The volume of professional disciplines and interdisciplinary modules must be of at least 50% of the content of training programs for engineering technician, as well as of at least 120 ECTS credits – for applied bachelor, 110 ECTS credits – for academic bachelor, 150 ECTS credits – for specialist and 30 ECTS credits – for master degree programs.

Duration of practical training for technicians must be at least 25 weeks, and for applied bachelors – not less than 18 weeks. The recommended duration of practical training for academic bachelors – at least 12 weeks, and for specialists – 16 weeks. In the master degree programs recommended volume of total practices and research – at least 50 ECTS credits.

Educational programs of higher education in the field of engineering and technology should contain course projects providing planning, design and application of engineering products, systems and processes. An important factor is execution of real projects demanded by the customer.

The program must culminate with the final qualification work focused on practical ac-tivities (training program for technicians and applied bachelors) or with the elements of re-search and development (academic bachelor, specialist and master programs).

3. Students and educational process

Students admitted for the program of secondary vocational education, bachelor or specialist degree programs must have a complete secondary education. Students admitted for the master program must complete a first cycle program (at least bachelor degree) and must demonstrate a necessary level of knowledge in natural sciences and mathematics.

Educational process must ensure the achievement of learning outcomes by all the students. The HEI running the program must have a system ensuring on-going evaluation of the ac-complishment of the curricular tasks as well as a feedback mechanism for continuous im-provement of the program.

When evaluating the program more attention should be paid to implementation of practice-oriented technologies, organization of independent work of students, using

open edu-cational resources available at HEI Internet-site.

An important element of educational process is the presence of academic adaptation system for students, student-centered educational environment and system of students' aca-demic mobility.

4. Faculty

Teaching staff in secondary education institutions and academic staff in HEIs must be repre-sented by experts so as to cover all of the curricular areas of the program. Teaching staff must have a sufficient level of qualification and systematically improve qualification by professional development, internships, additional training to master their teaching skills.

The teaching staff industrial experience in the relevant field and membership in professional associations, awards, grants and fellowships are of important consideration in program evalu-ation. Faculty members must be actively involved in technical projects (secondary vocational education programs), engineering, research, design, production projects(higher educational programs) that must be evidenced by research and methodological reports, participation in scientific conferences, publications. The faculty must be involved in the improvement of both the whole program and each discipline.

Each teaching staff member must comprehend and prove the relation and links of his disci-pline to other curricular components, and understand the role of his discipline in educational process. Involvement of experts from industry and research institutions in the training process is of important consideration in program evaluation.

The number of teaching staff with doctoral degrees (PhD and DSc) must be not less than 50% of the faculty participating in applied bachelor program delivery, not less than 60% of the faculty participating in academic bachelor and specialist programs delivery, and not less than 80% of the faculty participating in master program delivery. Attracting experts with doctoral degrees in the training process is considered as the advantage for the evaluated pro-gram. The faculty turnover must not exceed 40% during the accreditation period.

5. Professional qualifications

Students must have been preparing for engineering practice through the whole period of study. The research and design experience must be based on the knowledge and skills ac-quired within the interdisciplinary modules of educational program, educational practical and on-the-job internships, conducting research, preparing course papers, final qualification papers and projects. Student's portfolio with the results of studying and research activity, par-ticipation in different kind of academic competitions, grants and other events.

The program must ensure the achievement of the learning outcomes required for engineering activity by all the graduates. Below there is a list of requirements to learning outcomes (competences) of graduates from engineering technician program (T), applied bachelor program (Ap. B), academic bachelor program (Ac. B), specialist program (S) and master program (M).

1. Professional profile (competences)

1.1. Knowledge and understanding

T. Apply knowledge of mathematics, natural science, humanities and socioeconomic sciences, specific engineering fundamentals for the solution of practical engineering problems relevant to area of specialization.

Ap.B. Apply basic knowledge of mathematics, natural science, humanities and socioeconomic sciences, specific engineering fundamentals for the solution of applied engineering problems relevant to training profile.

Ac.B. Apply basic and in-depth knowledge of mathematics, natural

science, humanities and socioeconomic sciences, engineering fundamentals in multidisciplinary context for the solution of complex engineering problems relevant to branch of engineering training.

S. Apply basic and specific knowledge of mathematics, natural science, humanities and socioeconomic sciences, engineering fundamentals in multidisciplinary context for the solution of complex engineering problems relevant to area of specialization.

M. apply in-depth knowledge of mathematics, natural science, humanities and socioeconomic sciences, engineering fundamentals in multidisciplinary context for the solution of innovative engineering problems relevant to branch of engineering training.

1.2. Engineering Analysis

T. Identify and solve practical engineering problems relevant to area of specialization using established known methods.

Ap.B. Formulate and solve applied engineering problems relevant to training profile using basic and specific knowledge, modern relevant analytic methods.

Ac.B. Formulate and solve complex problems of engineering analysis relevant to branch of engineering training using basic and specific knowledge, modern relevant analytic and modeling methods.

S. Formulate and solve complex problems of engineering analysis relevant to area of specialization using basic and specific knowledge, modern relevant analytic and modeling methods.

M. Formulate and solve innovative problems of engineering analysis relevant to branch of engineering training using in-depth engineering fundamentals, modern relevant analytic and complex modeling methods.

1.3. Engineering Design

T. Solve practical engineering problems and contribution to design of engineering products, systems and processes relevant to area of specialization including an awareness of societal, health and safety, environmental and other considerations.

Ap.B. solve applied engineering problems and participation in design of engineering products, systems and processes relevant to training profile including an awareness of societal, health and safety, environmental and other considerations.

Ac.B. Execute complex engineering projects of engineering products, systems and processes relevant to branch of engineering training including an awareness of societal, health and safety, environmental and other considerations.

S. Execute complex engineering projects of engineering products, systems and processes relevant to area of specialization including an awareness of societal, health and safety, environmental and other considerations.

M. Execute innovative engineering projects of engineering products, systems and processes relevant to branch of engineering training including an awareness of hard societal, health and safety, environmental and other considerations.

1.4. Investigations

T. Conduct searchers of information to solve practical technical problems relevant to area of specialization, locate and search relevant codes and catalogues, conduct standard tests and measurements.

Ap.B. Conduct investigations to solve applied engineering problems relevant to train-ing profile, conduct searches of literature use data bases, design and conduct experiments.

Ac.B. Conduct investigations to solve complex engineering problems relevant to branch of engineering training, design and conduct experiments, interpret the data applying basic and in-depth knowledge.

S. Conduct investigations to solve complex engineering problems relevant to area of specialization, design and conduct experiments, interpret the data applying basic and specific knowledge.

M. Conduct investigations to solve innovative engineering problems relevant to branch of engineering training, design and conduct complex experiment, interpret the data and draw conclusions applying in-depth knowledge and modern methods.

1.5. Engineering Practice

T. Apply techniques, resources, and modern engineering and IT tools including prediction and modelling to solve practical technical problems relevant to area of specialization , with an understanding of the limitations.

Ap.B. Select and apply techniques, resources, and modern engineering and IT tools, including prediction and modelling, to solve applied engineering problems relevant to training profile, with an understanding of the limitations.

Ac.B. Develop, select and apply techniques, resources, and modern engineering and IT tools, including prediction and modelling, to solve complex engineering problems relevant to branch of engineering training, with an understanding of the limitations.

S. Develop, select and apply techniques, resources, and modern engineering and IT tools, including prediction and modelling, to solve complex engineering problems relevant to area of specialization, with an understanding of the limitations.

M. Develop and apply techniques, resources, and modern engineering and IT tools, including prediction and modelling, to solve innovative engineering problems relevant to branch of engineering training, with an understanding of strict limitations.

1.6. Specialization and focus on labor market

T. Demonstrate competencies associated with special features of tasks, objects and types of engineering technology practice relevant to area of specialization at enterprises and organizations of potential employers.

Ap.B. Demonstrate competencies associated with special features of tasks, objects and types of applied engineering activity relevant to training profile at enterprises and organizations of potential employers.

Ac.B. Demonstrate competencies associated with special features of tasks, objects and types of complex engineering activity profile and branch of engineering training at enterprises and organizations of potential employers.

S. Demonstrate competencies associated with special features of tasks, objects and types of complex engineering activity relevant to area of specialization at enterprises and organizations of potential employers.

M. Demonstrate competencies associated with special features of tasks, objects and types of innovative engineering activity profile and branch of engineering training at enterprises and organizations of potential employers.

2.General competencies (Transferable skills)

2.1. Management

T. Apply knowledge of engineering technology practice management principles relevant to area of specialization.

Ap.B. Apply basic knowledge of applied engineering activity management principles relevant to training profile.

Ac.B. Apply basic and in-depth knowledge of complex engineering activity management principles relevant to branch of engineering training.

S. Apply basic and specific knowledge of complex engineering activity management principles relevant to area of specialization.

M. Apply knowledge in project and financial management for innovative engineering activity relevant to training profile.

2.2. Communication

T. Communicate effectively with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, give and receive clear instructions, make effective presentation on results of engineering

technology practice relevant to area of specialization.

Ap.B. Communicate effectively with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, give and receive clear instructions, make effective presentation on results of applied engineering activity relevant to training profile.

Ac.B. Communicate effectively using foreign language with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentation on results of complex engineering activity relevant to branch of engineering training.

S. Communicate effectively using foreign language with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentation on results of complex engineering activity relevant to area of specialization.

M. Communicate effectively using foreign language with the engineering community and with society at large, by being able to comprehend and write effective reports and design documentation, make effective presentation on results of innovative engineering activity relevant to branch of engineering training.

2.3. Individual and Team Work

T. Function effectively as an individual, and as a member of a team to solve practical technical problems relevant to area of specialization.

Ap.B. Function effectively as an individual, and as a member or leader of a team to solve applied engineering problems relevant to training profile.

Ac.B. Function effectively as an individual, and as a member or leader of a multidisciplinary team sharing responsibility and delegating authority to solve complex engineering problems relevant to branch of engineering training.

S. Function effectively as an individual, and as a member or leader of a multidisciplinary team sharing responsibility and delegating authority to solve complex engineering problems relevant to area of specialization.

M. Function effectively as an individual, and as a member or leader of a multidisciplinary team sharing responsibility and delegating authority to solve innovative engineering problems relevant to branch of engineering training.

2.4. Professional Ethics

T. Personal responsibility and commitment to professional ethics engineering technology practice.

Ap.B. Personal responsibility and commitment to professional ethics in applied engineering activity.

Ac.B. Personal responsibility and commitment to professional ethics in complex engineering activity.

S. Personal responsibility and commitment to professional ethics in complex engineering activity.

M. Personal responsibility and commitment to professional ethics in innovative engineering activity.

2.5. Social Responsability

T. Demonstrate understanding of the societal, health, safety issues and the consequent responsibilities for engineering technology practice relevant to area of specialization and con-tribute to ensure sustainable development.

Ap.B. Demonstrate understanding of the societal, health, safety, cultural and legal issues and the consequent responsibilities for applied engineering activity relevant to training profile and take active part to ensure sustainable development.

Ac.B. Demonstrate understanding of the societal, health, safety, cultural and legal issues and the consequent responsibilities for complex engineering activity relevant to branch of engineering training and ensure sustainable development.

S. Demonstrate understanding of the societal, health, safety, cultural and legal issues and the consequent

responsibilities for complex engineering activity relevant to area of specialization and ensure sustainable development.

M. Demonstrate understanding of the societal, health, safety, cultural and legal issues and the consequent responsibilities for innovative engineering activity relevant to branch of engineering training and ensure sustainable development.

2.6. Lifelong learning

T, Ap.B., Ac.B., S, M. Recognize the need for, and have the ability to engage in independent and lifelong learning

Higher educational institution develops and supplements presented above requirements to professional and general competencies of graduates of secondary and higher vocational education programs in the field of engineering and technology as well as planned learning outcomes relevant to area of specialization or training profile and in order to meet the requirements of professional standards as well as the labor market and employers requirements (demands of strategic partners).

The department/institution must have an assessment process of learning outcomes for both the whole program and each discipline with documented results. The results must be used for further program and educational process improvement.

3. Program resources

The educational program facilities, information and financial resources must be in full correspondence with the license requirements and meet the program objectives.

The institution resources must be sufficient to provide all students opportunity to achieve program learning outcomes. Particular attention is paid to the use of modern educational technologies and information resources, including the organization of an independent work and research activities of students.

One of the key elements in delivering higher vocational programs is the availability of Internet-access to the world's information resources for teachers and students, including na-tional and foreign databases of the latest scientific publications. HEI must have sufficient re-sources (classrooms, associated equipment and tools) to provide research, design, engineering and technology activities of students to facilitate acquisition of practical experience in devel-opment of engineering products and systems, including teamwork environment.

The institution financial policy and management must aim to improve the quality of the program and provide continuous development of competencies and skills of teaching and support staff.

Organization and management of the educational unit responsible for the program must be effective and contribute to the implementation of educational programs. An important factor is the presence in the educational organization of modern quality management system.

The institution/department management must be efficient to guarantee the accom-plishment of program outcomes and promote improvement of the program.

Existence of quality management system of the institution is an important considera-tion in program evaluation.

4. Graduates

To ensure relevance and competitiveness of the educational program and its continuous improvement HEI must have monitoring system to study the labor market needs, as well as to support graduates and get feedback from them, especially during the first 3-5 years upon graduation from the program.

Conclusions

The given above new accreditation criteria for programs of secondary vocational edu-cation, applied and

academic bachelor programs, specialist and master programs correspond with the international standards IEA Graduate Attributes and Professional Competences in terms of the requirements applied under Dublin Accord, Sydney Accord and Washington Ac-cord, correspondingly.

Graduates of accredited by AEER programs of secondary vocational education will be able to apply for the procedure of certification and registration in the International Engineer-ing Technicians Register. Graduates of accredited by AEER applied bachelor programs will be able to apply for the procedure of certification and registration in the International Engi-neering Technologists Register, and graduates of the accredited academic bachelor and spe-cialist programs will be able to apply for certification and registration in the APEC Engineer Register and International Professional Engineers Register.

Criteria for professional accreditation of bachelor, specialist and master degree pro-grams also correspond with EUR-ACE Framework Standards for Accreditation of Engineering Programmes in terms of requirements to the programs of First and Second Cycle in framework of Bologna Process.

Graduates of accredited by AEER programs of higher vocational education will be able to apply for certification and registration in FEANI Register and have an advantage in obtaining the title of "European Engineer" (EurIng) and European ENGCard.

The criteria presented in this paper are going to be used for professional accreditation of educational programs (secondary and higher vocational education) developed on the basis of the Federal State Educational Standard of the Russian Federation. Higher education institutions are recommended to use these criteria when designing new and updating existing educational programs to meet the requirements of the amended version of the Federal State Educational Standard, adapted to the Federal Law "On Education in the Russian Federation" dated December 29, 2012.

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