EXPERT OPINION

on the developed modular Vocational Master's education programs in specialty 6M070900 "Metallurgy" at the S. Toraighyrov Pavlodar State University

The educational programs have the following specializations:
- Technological innovations in material studies and metallurgical engineering;
- Technological innovations in material studies and metal processing;
- Life safety of and protection of the environment in metallurgy.

The educational programs are developed within the State Program of Industrial-Innovative Development of Kazakhstan during 2015-2019. The main objectives are to improve competitiveness through diversification and modernization, development of a competitive domestic production, innovation for complex processing of ores, release of new products for base metals related sectors of the economy, modernization of logistics, and development of industrial base of branch institutes.

The term of study at the master program in "Metallurgy" is 1.5 years with 90 ECTS.

The educational program includes general and specific modules that provide formation of economic, administrative, fundamental research, and applied skills.

The developed modules provide advanced training in the field of materials science, engineering, assessment of life safety and environmental sustainability of production, production management, interdisciplinary knowledge including studies of structure, properties, processing, and application of metallic materials.

The general and specific competencies that graduates will acquire within the specialty master program of "Metallurgy" are:
- Ability for innovation, entrepreneurship, and self-development;
- Knowledge of the current state and prospects of development of the metallurgical field of Kazakhstan and Pavlodar region;
- Knowledge of a foreign language to the extent necessary for the professional activity;
- Ability to work in a team, building a professional qualification structure of a working unit, management of staff;
- Ability to plan and organize the implementation of a production plan department, to analyze industrial activity units and maintain control of the implementation of planned targets;
- Ability to organize and supervise the enforcement of required occupational health and safety and sustainability of environment;
- Ability to organize innovative activities in the enterprise, to develop and improve production processes in order to improve energy and resource efficiency, to assess and control quality of developed products;

- Problem-solving and organization of environmental management and waste production and handling
- Correct use of information resources;
- Inspection, verification, audition of materials and metallurgical processes;
- Conduct research in materials studies and metallurgy;
- Ability to plan and conduct expert reports on materials and processes for experts and non-professionals.

Graduates of the master's program will be able to work as professionals in the metallurgical field and related industries, in areas related to materials research and production, environment, innovation, and management of related industrial activities.

A new laboratory "Computer simulation and testing processes in metallurgy" is scheduled to open for the development of research competences within the specialty "Metallurgy". This laboratory is intended for studies and research work, and includes 98 units of laboratory equipment. The main methods of research planned for use in the laboratory are: gravity; titrimetry; fluorometry; coulometry; spectrophotometry; X-ray spectral techniques; photocolorimetry; atomic absorption; mechanical testing of materials; metallographic and electron microscopic studies of materials; and computer modeling. Purchase of laboratory equipment will be done from world leading producers such as "Retsch", "FRITSCH"; "JET Equipment & Tools"; "Bruker Materials"; "Progress enginiring"; "Phenom World"; "IKA®-Werke GmbH & Co", and "Olympus

Important drivers for industrial development is innovative efficiency and sustainability of natural resource use and environment. In view of this, the aim of the master program is to develop necessary knowledge of future specialists in Metallurgy. The program should also include important aspects such as environmental protection and occupational health.

The undersigned has taken part of the planned educational program and enclosed syllabi. After assessing the planned distribution of subjects by semester, the undersigned recommends the following:

- That courses 4.1 Business organization and 4.2 Business administration are joined in to 4.1 Business organization and administration.

- That course 4.3 The organization of quality management system and system of ecological management at the enterprise is renamed to 4.3 Environmental sustainability and corporate social responsibility in metallurgy industry.

- That course 5 The organization and management of industrial safety and labor protection in petrochemical branch is renamed to 5 Planning and management for labor health protection and sustainable metallurgy process development.

We suggest to give some of the courses using online platform taught by professors from Lund University. However, this requires further discussion.

We recommend to prepare all course syllabuses including literature and lecture notes before the program starts. This could be moderated with ongoing course programs at Lund University.

We believe that with the above modifications, the structure and content of the educational programs of developed modular Vocational Master's programs in specialty 6M070900 "Metallurgy" corresponds to similar Master programs in the European educational space, and will allow reaching the planned learning outcomes.

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