MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION

Federal State Autonomous Education “Ural Federal University named after the first President of Russia B.N. Yeltsin”

Institute of New Materials and Technologies

Signed and Approved

Vice-rector for Research

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ V.V. Kruzhaev

«\_\_\_» \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 2018 г.

COURSE PROGRAM

**DIRECTIONS FOR IMPROVING THE EFFICIENCY OF FOUNDRY PRACTICES**

|  |  |
| --- | --- |
| **The list of information about the work program of the discipline** | **Credentials** |
| **Educational program**  Foundry practices (05.16.04) | **Code of EP** 22.06.01  **Curriculum** № 6390 (version 3) |
| **Direction**  Materials technology | **Code of direction and level of preparation** 22.06.01 |
| **Level of preparation**  Training of highly qualified personnel |
| **FSES** | **Details of the order of the Ministry of Education and Science of the Russian Federation on the approval of the FSES:** № 888 of July 30, 2014, as amended on April 30, 2015 |

**Ekaterinburg**

**2018**

**1. GENERAL CHARACTERISTICS OF THE DISCIPLINE "Directions for improving the efficiency of foundry practices"**

**1.1. Annotation of the content of the discipline**

The purpose of the discipline is to explore the possibilities of improving the efficiency of production of shaped castings and ingots based on the best domestic and foreign experience. There are some tasks to achieve this goal:

- identification of problems of the technological process;

- identification of possible solutions of technological problems;

- technical and economic analysis of solution methods.

**1.2. The language of the implementation of the discipline is Russian.**

**1.3. Planned learning outcomes of the discipline**

As a result of mastering the discipline, a graduate student must acquire the following competencies:

- the ability to analyze critically and evaluate modern scientific achievements, to generate new ideas in solving research and practical problems, including in interdisciplinary areas (UC-1);

- the ability and willingness to prove theoretically and optimize the technological processes of obtaining advanced materials and the production of new products from them, taking into account the consequences for society, the economy and the environment (GPC-1);

- the ability and willingness to develop and produce technological documentation for promising materials, new products and measures of technical quality control of manufactured products (GPC-2);

- the ability and willingness to economically evaluate the production and non-production costs of creating new materials and products, to work to reduce their cost and improve quality (GPC-3);

- the ability and willingness to comply with regulatory requirements that ensure the safety of production and operational activities (GPC-4);

- the ability and willingness to use in practice the integrated knowledge of natural science, general vocational guidance and special disciplines to understand the problems of the development of materials science, the ability to put forward and implement in practice new highly efficient technologies (GPC-5);

- the ability and willingness to perform theoretical and experimental research as a leading performer using computer technology (GPC-6);

- the ability to choose instruments, sensors and equipment for conducting experiments and recording their results (GPC-10);

- the ability and willingness to develop technological process, technological tooling, working documentation, route and operational flow charts for the manufacture of new products from advanced materials (GPC-11);

- the ability and willingness to participate in carrying out technological experiments, to carry out technological control in the production of materials and products (GPC-12);

- the ability and willingness to participate in the certification of materials, semi-finished products, products and technological processes of their manufacture (GPC-13);

- the ability and willingness to assess investment risks in the implementation of innovative materials science and design and technology projects and the introduction of advanced materials and technologies (GPC-14);

- the ability and willingness to demonstrate a systematic understanding of the current state and problems of the chosen (professional) branch of scientific knowledge (PC-1);

- the ability and willingness to conduct research in the chosen (professional) field of scientific knowledge using modern methods and technologies (PC-2);

- the readiness to identify, develop problems, using the scientific approach, conduct and implement the results of research in the chosen (professional) branch of scientific knowledge (PC-3);

- the ability to critically analyze, evaluate and synthesize new ideas in the chosen (professional) branch of scientific knowledge, related fields (PC-6).

As a result of mastering the discipline, a graduate student should:

**Know:**

- the current state of foundry practices, key problems, unsolved scientific and technical problems that are currently being investigated in our country and abroad.

**Be able to:**

- economically evaluate production and non-production costs for the production of new materials and products, carry out work to reduce their cost and increase quality;

- conduct a patent search on research topics, draw up materials for obtaining patents, analyze, systematize and summarize information from global computer networks economically.

**Acquire** (demonstrate skills and experience):

- assessment methodology of modern scientific achievements, generating new ideas in solving research and practical problems, including in interdisciplinary areas.

**2. CONTENT OF THE DISCIPLINE**

|  |  |  |
| --- | --- | --- |
| **Code of**  **sections, topics** | **Section, topic of the discipline** | **Content** |
| **Р1** | **Defining Technological Process Problems** | Identification of reserves for increasing the efficiency of the production process by changing / applying:  - alloy composition;  - alloy melting technology;  - alloy refining;  - alloy modification;  - other processing of the alloy (thermo-time, vibration, etc.);  - heat treatment of casting;  - model equipment;  - casting materials, including molding compounds and paints;  - new equipment and technologies;  - methods of organizing the preparation of production;  - the intensification of the principle of directional crystallization;  - other methods to improve the efficiency of foundry production.. |
| **Р2** | **Identification of possible solutions of technological problems** | Study of examples of solving similar problems (including in related branches of science and technology) of the technological process in domestic and foreign literature, including periodicals, patents, Internet resources.  Simulation of process, analogues, methods of solution. |
| **Р3** | **Technical and economic analysis of methods for solving problems** | Assessment methods economic efficiency. Examples of calculating the economic effect. |

**4.3.1. Indicative list of homework topics**

1. Determination of the economic effect of improvement in the technology of refining.

2. Determination of the economic effect of improvement in the technology of modification.

3. Determination of the economic effect of changes in the composition of the alloy.

4. Determination of the economic effect of improvement in the technology of thermal tempering casting

5. Determination of the economic effect of vibration casting processing.

6. Determination of the economic effect of improvement in directional solidification of casting.

7. Determination of the economic effect of improvement in the technology of smelting alloys.

8. Determination of the economic effect of the introduction of new molding materials.

9. Determination of the economic effect of improvement in tooling.

10. Determination of the economic effect of improvement in the technology of heat treatment of castings.

**4.3.2. Indicative topics of individual or group projects**

The names of the design works with the indication of the sections of the discipline to which they relate are listed in Table. 4.1.

Table 4.1 - the Distribution of creative works in sections of the discipline

|  |  |  |  |
| --- | --- | --- | --- |
| Work number | Section number | Name of work | Time for the work, hour |
| 1 | Р1 | Selection of the composition of the alloy, technology modifying, refining, other types of metallurgical processing. | 4 |
| 2 | Р1 | Selection of the material of the form, the implementation of the principle of directional crystallization, the structuring of the casting | 4 |
| 3 | Р2 | Methodology for finding information on the identified problem | 4 |
| 4 | Р3 | Calculation of the economic effect | 4 |

**6.3.4. List of indicative questions for the credit**

1. Methods for calculating the economic effect.

2. Computer simulation systems for foundry processes

3. Methods to improve the directional solidification of castings and ingots.

4. Modern high-strength alloys and master alloys for their production.

5. Eutectic Composite Materials

6. Dispersion-strengthened composite materials

7. Composite materials in-situ and ex-situ

8. Modern technologies of modifying

9. Modern modifiers

10. Modern methods of refining metals and alloys.

11. Modern methods of metallurgical processing of melts.

12. Modern molding and core mixtures, binder compositions.

13. Modern casting paints, coating forms

14. Modern foundry equipment

15. Modern lining materials.

**7. TRAINING-METHODOLOGICAL AND INFORMATION SUPPORT OF DIS-CYPLINE**

**7.2. Foundry Information Resources**

1. Russian association of founders <http://www.ruscastings.ru>

* 1. 2. Ukrainian association of founders

1. [http://lityo.com.ua](http://lityo.com.ua 3)

3. American Foundry Society http://www.afsinc.org/

4. Bundesverband der Deutschen Gießerei-Industrie <http://www.bdguss.de>

5. Russian founders’ site http://rsl.npp.ru

**7.4. Databases, information and reference and search engines**

1. Official site of legal information http://pravo.gov.ru
2. Web portal of information education resources of UrFU http://study.urfu.ru/info
3. Electronic database of normative documents ГОСТЭКСПЕРТ http://gostexpert.ru
4. Search systems: www.yandex.ru, google.ru www.rambler.ru.