**THE MINISTRY OF EDUCATION OF THE REPUBLIC OF AZERBAIJAN**

**Approved by the decree … of the Ministry of Education of the Republic of Azerbaijan of …**

**STATE STANDARD OF HIGHER EDUCATION**

**STATE STANDARD OF THE STUDY FIELD OF CHEMICAL ENGINEERING**

**Specialty ciphers and names:**

**050641 – Chemical engineering; 060641 – Chemical engineering**

**BAKU – 2019**

1. **General provisions**

The State standard of Bachelor level “050641- Chemical engineering” and Master level “060641 – Chemical engineering” specialty (hereinafter, the State standard) has been developed pursuant to the “Law on Education” of the Republic of Azerbaijan, the “State standard and programme for higher education” approved by the relevant decisions of the Cabinet of Ministers of the Republic of Azerbaijan, the requirements of the “Rules on the content and organization of bachelor education”, the “Classification of bachelor level specialties of higher education”, “National Qualifications Framework for Lifelong Learning of the Republic of Azerbaijan”, “ Rules on Organizing the Credit system education at bachelor and master levels of higher education institutions, main (basic higher) medical education and master level studies of Azerbaijan National Academy of Sciences” .

The State standard of the study field of Chemical engineering shall be applied to the first and second cycle university study programmes. Study programmes may be organised on a full-time and/or part-time basis. This State standard aims to:

* Assist higher education institutions in designing, implementing and assessing study programmes;
* Inform students and employers about the knowledge and skills acquired by the graduates;
* Give guidelines to experts who assess the study programmes.

The State standard is obligatory for all higher education institutions which function in the territory of the Republic of Azerbaijan regardless of their subordination, ownership and organizational and legal forms and carry out bachelor studies in this specialty.

Abbreviations used in the document are as follows:

**SP** - Study Programme

 **GC -** General competences

 **PC** - Professional competences

**2. Competences and learning outcomes of the study programmes in the study field of Chemical engineering**

The following general and professional competences shall be developed, and following learning outcomes should be attained within the study programme at Bachelor level:

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| **Generic competences** | **Programme learning outcomes** |
| **1.** | Ability to communicate effectively in writing and orally in first and one foreign language | **1.1.** | To use language skills obtained in the field of chemistry and technology  |
| **1.2**  | To use language skills acquired in order to collect data from external sources and to exchange knowledge  |
| **2.** | Ability for abstract thinking, analysis and synthesis, and to develop argumentation with critical mind. | **2.1.** | To analyze a problem and to identify the main requirements |
| **2.2** | To substantiate his/her opinion and have a critical approach for their results obtained |
| **3.** | Ability to identify, select, analyse and summarize various specialized resources to document a subject | **3.1.** | To identify to what extent the problem is relevant  |
| **3.2** | To analyze the outcomes obtained and compare them with outcomes obtained from other sources |
| **3.3**  |  To summarize the outcomes obtained and identify key points |
| **4.** | Ability to use digital tools of reference and rules of computer security to acquire, process, produce and disseminate information as well as to collaborate internally and externally | **4.1.** | To be able to safely use computer technologies in order to get knowledge from digital information sources  |
| **4.2** | To be able to analyze, process and share the data obtained |
| **5.** | Ability to plan and organise one’s own activities, self-learning and skills’ enhancement | **5.1** | To be able to independently plan and implement experiments and interpret the outcomes achieved |
| **6.** | Ability to act in a socially and environmentally responsible way, demonstrate civic awareness and ethical reasoning | **6.1** | To have an understanding of professional, ethical and safety issues, and also assume responsibilities specific for engineering |
| **7.** | Ability to step back from a situation, self-evaluate and questioning himself in order to improve knowledge and skills | **7.1** | To have a critical approach toward one’s knowledge and skills, and to be able to develop the skills obtained |
| **7.2**  | To be able to respect the opposite side’s views and reckon with others’ views |
| **8.** | Ability to establish their role and mission within an organization, to adapt and take initiative. | **8.1** | To have a well-developed personality and to get actively involved in education and training process |
| **9.** | Ability to work as part of a team while being independent and responsible with respect to a project | **9.1** | To be able to work efficiently in multidisciplinary groups, in particular in projects that require engineering skills |
| **9.2** | To be able to build work-related activities based on relevant laws, legal acts, standards, methods and guidelines.  |
| **9.3** | To work out a strategy for his/her own personal and professional development in order to boost work efficiency in multidisciplinary working conditions.  |
| **Professional competences** | **Programme learning outcomes** |
| **1.** | Utilise appropriate concepts and methods in the fields of mathematics, physics, biology, English language, and computer science, and to address and solve problems in chemistry. | **1.1.** | To be able to solve complex problems in chemistry by using appropriate concepts of mathematics.  |
| **1.2.** | To be able to solve complex problems in chemistry by using appropriate methods and tools of computer sciences |
| **1.3.** | To be able to perform tasks and solve problems in chemistry by using technical supports or scientific documents in English |
| **2.** | Utilise, develop use and master fundamental concepts and methods of all fields of organic, inorganic, analytical, physical and theoretical chemistry to address and solve global problems in chemistry  | **2.1.** | To be able to define a problem in rigorous scientific terms. |
| **2.2.** | To be able to formulate hypotheses and to develop a resolution process |
| **2.3.** | To be able to identify concepts and methods of molecular and physical chemistry that are connected to a problem to solve |
| **2.4** | To be able to use and to implement concepts and methods of molecular and physical chemistry that are connected to a problem to solve |
| **3.** | Identify the different stages of experimental approach and lead independently and efficiently experimental protocol in organic, inorganic, analytical and physical chemistry. | **3.1.** | To be able to select, implement and document laboratory processes while carrying out a chemical synthesis |
| **3.2.** | To be able to obtain and/or extract chemical compounds using standard methods of synthesis |
| **3.3.** | To be able to isolate, purify and characterize compounds while carrying out a chemical synthesis |
| **4.** | Analyze criticaly experimental protocol and propose adapted improvements to increase efficiency and safety | **4.1.** | To be able to analyze, compare and select experimental protocols taking into account state of art, safety and efficiency |
| **4.2.** | To be able to test and modify experimental protocols taking into account state of art, safety and efficiency |
| **5.** | Choose and use appropriate scientific instruments and methods to study selected physical property or to characterize compounds or materials | **5.1** | To be able to select and use scientific instruments and methods to characterized or analyze compounds or materials |
| **5.2** | To be able to select and use scientific instruments and methods to study selected physical properties of compounds or materials |
| **6.** | Analyze, exploit and present experimental data using modelisation and/or taking into account sources of errors and uncertainty with a critical mind | **6.1** | To be able to take into account sources of errors and uncertainty with a critical mind and to use appropriate analysis software of data |
| **6.2** | To be able to select or implement models and/or to use modelisation tools or softwares to study phenomena or properties  |
| **7.** | Identify specific regulations and implement the main prevention measures in terms of health, safety and environmental responsability | **7.1** | To be able to identify and support the various safety and regulatory issues related to the use of chemical products and experimental protocols |
| **7.2** | To be able to design protocols and processes for laboratory or companies that meet the economics, ecology and social aspects requirements |

The Master level general and professional competencies must be built up on the general and professional competencies acquired in the studies at Bachelor level. Additionally, a graduate of Master level shall master the general and professional competences by achievement of the following learning outcomes within the study programme at Master level:

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| **Generic competences** | **Programme learning outcomes** |
| **1.** | Ability to work in a team, in an interdisciplinary and international environment | **1.1.** | To be able to work efficiently in multidisciplinary teams, in particular in projects that require engineering skills  |
| **1.2** | To be able to demonstrate a high level of language knowledge, communication, project and team management skills |
|  **1.3** | To be able to effectively act as a leader of a team of people with different qualifications  |
| **1.4** | To be able to work and communicate effectively both in national and international contexts  |
| **2.** | Ability to address and respond well to situations in a new and original ways within the given context |  **2.1** | To be able to apply innovative methods and develop new scientific methods while solving problems based on basic principles  |
|  **2.2**  | To be able to analyze and solve the problems with competitive technical indices and that are unusual or uncertain from a scientific point of view |
| **…** |  |
| **3.** | Ability to identify, analyse and define the significant elements constituting a problem in order to solve it effectively and with good criteria | **3.1** | To be able to determine how relevant the problem is  |
|  **3.2**  | To analyze the outcomes obtained and compare them with outcomes obtained from other sources |
|  **3.3** | To summarize the outcomes obtained and identify key points |
| **4.** | Ability to do fundamental and applied research and apply its results independently for solving tasks in a new or unfamiliar environment, implement innovations | **4.1**  | To be able to perform, coordinate and document laboratory processes while carrying out a quantitative analysis |
| **4.2** | To be able to obtain and extract chemical compounds using standard methods and synthesis |
| **4.3**  | To be able to use innovative approaches aimed at practical solutions to problems  |
| **Professional competences** | **Programme learning outcomes** |
|  **1**  | Document in an exhaustive and synthetic way an emerging method, devices or system in one’s field of competencesIdentify, analyze and assimilate the main concepts of a whole production process | **…** |  |
|  |  |  |
| **2** | Build, plan and implement a production process project | **…** |  |
|  |  |  |
| **3** | Design and implement autonomously a new chemical engineering process using state of the art methods and equipment. | **…** |  |
|  |  |  |
| **4** | Formatting and presenting technology and engineering report |  |  |
| **5** | Integrate and contribute autonomously to a collaborative engineering project |  |  |

1. **The scope of study programmes in Chemical engineering**

The scope of a **Bachelor level study programme in Chemical engineering** shall be

no less than 240 credits, of which:

* no less than 165 credits should be for special subjects in the study field of Chemistry;
* no less than 60 credits should be for practical work in scientific teaching laboratory;
* no less than 60 credits should be for languages;
* no less than 15 credits should be connected with the development of employability skills;
* no less than 15 credits should be for the general university study subjects;
* no more than 60 credits may be for subjects elected by the student from among the established alternatives for specialisation in the same study field (area) or a module(s) or subject(s) in another field (area) or general university study subjects, practice or free electives.

The minimum overall size of work placements should be 15 credits.

A degree programme ends in the assessment of the graduate’s competences during the final state graduation examination (all subjects) or defence of a graduation work (project), for which at least 12 credits are allocated.

The scope of a **Master level study programme in Chemical engineering** shall be

no less than 120 credits, of which:

* 60 credits at least should be assigned to the core subjects of the study field, the content of which must be of a higher problematic and scientific level than the basic subjects taught as part of the Bachelor level programme;
* no more than 30 credits may be assigned to elective subjects undertaken by the student from among the university-prescribed alternatives the aim of which is to prepare a student for doctoral studies (research,) or practical activities (professional practice) or to subjects in another field of study in the case of an inter-disciplinary study programme, also to general subjects and free electives necessary to attain the learning outcomes of the programme.
* no less than 30 credits shall be assigned to the writting and presentation of the final project and the final examination.
1. **Teaching, learning and assessment**

Teaching, learning and assessment activities shall be organised in such a way that students can effectively achieve the intended learning outcomes of the study programme.

The applicable teaching and learning methods shall be described, constantly reviewed and improved in light of changing needs of the labour force, the latest scientific achievements in Chemical engineering and modern didactic requirements. The reaching and learning strategy shall help the students acquire relevant expertise, skills and practical skills necessary for professional activities.

The content of teaching shall be constantly updated and improved by integrating new knowledge and teaching methods in the study process corresponding to the concept of lifelong learning. Students shall be prepared and encouraged to follow the principles of this concept during their studies.

The studies shall provide for practical training to strengthen practical skills of students and form their working skills.

In different stages of studies, the same teaching and learning methods may be used, differing in scope and complexity of tasks, student’s autonomy, etc.:

Lectures; Laboratory activities; Individual counselling; Seminars (teaching in small groups); Practice classes; Demonstration activities; Vocational practical training (recommended location is an industrial company or another research and higher education institution); Individual or team projects; Teaching via the Internet with a virtual teaching environment; Field trips; Case studies; Writing of summaries and essays; Search for and summarising of required information, reading of books and articles; Preparation of oral presentations. One day visit in a company, flipped classroom, bibliographic analysis and or synthesis, pair to pair teaching.

The study assessment system shall ensure feedback to students about their learning achievements and the justification of assessment of their work.

A variety of assessment methods for students’ achievements shall be used, such as:

Written or oral examination; Thesis and its defense; Laboratory reports and defense; Problem-solving exercises; Oral presentations and displays of posters; Individual or team project report; Practical training report; Colloquium; Test papers with closed and/or open questions; Written papers (literature reviews, essays, etc.). On-line questionnaires, Pair evaluation, Questions on course production, Laboratory practice, e-Portfolio construction, Chat forum on courses, web-profiles on professional social networks.

When assessing learning outcomes, teachers should follow the principles of objectivity, transparency, impartiality, mutual respect and benevolence.

The methods applied to the assessment of learning outcomes shall be based on clearly formulated criteria allowing to correctly and reliably reflect the level of knowledge, abilities and skills achieved by the student during (subject) studies. Assessment criteria shall demonstrate how the level of student’s acquired knowledge and skills correspond to the intended learning outcomes defined by the study programme.

Students shall be given the opportunity to discuss with the teachers/assessors all the aspects of their studies, including their assessments. An appeal concerning the assessment process or assessment grade shall be submitted and considered following the procedure established by a higher education institution.

Individual assessments of students’ study subjects shall not be made public.

1. **Subjects in study field of Chemical engineering**

Based on the Bachelor and Master level studies learning outcomes in the study field of Chemical engineering the learning outcomes of the subjects and description of subjects, the number of ECTS allocation for each subject and application of teaching, learning and assessment methods must be developed by teaching staff of the universities.

A special matrix of correlations to determine the correlation of learning outcomes and the study subjects that make the programme must be used at the University. The learning outcomes of the programme should be listed in the matrix and be related to single subjects of the programme by which the particular learning outcomes of study programme are developed (Annex 1). Each subject must be described showing correlation of learning outcomes of the subject with learning outcomes of the study programme (Annex 2).

When designing a study programme, the needs and recommendations of Chemical engineering knowledge-intensive businesses and the needs of the state and the public shall be taken into account. The study programme shall be regularly improved and updated and reflect the new developments in science and methodological studies. Programme developers shall ensure that the study programme includes innovative and relevant topics. The list of recommended subjects for Bachelor and Master level is presented in Annex 3. This list must be updated at least each 3 years to meet the latest scientific developments and labor market requirements.

1. **Infrastructure, teaching base and staff capacity**

Teaching of subjects, organization of internships and realization of scientific research according to the syllabus drafted in compliance with the study programme of “050641 – Chemistry” and “060641 – Chemistry” specialties of the higher education institution require infrastructure like ICT-equipped cabinets and labs, computer rooms, workshops etc. Learners shall have access to local network, internet, databases, e-libraries, search systems of HEI.

Following scientific equipments are required to achieve the program: U-visible and IR spectrophotometers, gas chromatoghs, high performance liquid chromatographs, X-ray diffractometer, NMR spectrometers etc...

As a rule, academic staff with scientific degrees or pedagogical titles teach the subjects. Persons from other institutions and organizations meeting these criteria may also be engaged in teaching.

As a rule, scientific supervision of Master dissertation is conducted by academic staff of a higher education institution with pedagogical title or scientific degree or persons from other organizations meeting these conditions.

1. **Requirements for a final state attestation and assessment**

Requirements for a final state attestation and assessment at Bachelor level are as follows:

* Bachelor study programmes are completed by the state attestation of learners.
* Learners who fulfil all the requirements of syllabus and successfully complete current attestations (attestations by subjects) may take part in the final attestation.
* Final attestation is compulsory for all learners, the period allotted for its preparation and organization is 6 months.
* Final attestation consists of final state graduation examination (all subjects) or a defence of graduation work.
* A student shall accumulate 240 credits at Bachelor level. Students who gathered credits envisioned in the specialty study programmes are considered to have mastered the programme. Students who fully complete the syllabus of the Bachelor study programme of a HEI are awarded “Bachelor” academic degree on the basis of the decision of the final State Attestation Commission.

Rules on organization and holding of final attestation are determined by the Cabinet of Ministers of the Republic of Azerbaijan.

Requirements on final state attestation and assessment at Master level are as follows:

* Final state attestation consists of the defense of a master dissertation. Requirements on the content, volume, structure of dissertation are set by the Ministry of Education of the Republic of Azerbaijan.
* Evaluation of learners' knowledge is conducted in line with the rules approved by the Cabinet of Ministers of the Republic of Azerbaijan.

Graduates are awarded Master academic degree and state diploma as a result of the Final State Attestation.

1. **Employability and further education of graduates**

Graduates of Chemical engineering studies may work in educational institutions, research institutes, manufacturing enterprises, develop new business, especially associated with the technique and technology, enterprises and other institutions.

The knowledge, skills and attitudes acquired during Chemical engineering studies shall be preconditions for graduates to engage independently in lifelong learning.

**Agreed with:**

Deputy Chief of Staff of the Ministry of Education

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Yagub Piriyev

Head of Science, Higher and Specialized Education Department of the Ministry of Education

\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Gültəkin Huseynova

Chairman of Working Group of the Ministry of Education developing State Education Standards for Technical specialties group\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Xaliq Yahudov

Chairman of the Scientific Methodogical Council of Chemistry and Chemical Technology Section of the Ministry of Education of the Republic of Azerbaijan \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Vagif Abbasov

**Annex 1. Matrix of correlation of study subjects and learning outcomes** *(to be filled by university staff)*

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| **Subject group** | **Subject** | **Learning outcomes** |
|  |  |  |  |  |  |
| **A1** | **A2** | **A3** | **A4** | **A5** | **A6** | **A7** | **B1** | **B2** | **B3** | **C1** | **C2** | **D1** | **D2** | **D3** | **D4** | **D5** | **E1** | **E2** | **E3** | **F1** | **F2** | **F3** | **F4** |
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**Annex 2. Learning outcomes for particular subjects** *(to be filled by university staff)*

**1.**

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| --- | --- |
| **Subject title** | **Code** |
|  |  |

**2.**

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| --- | --- |
| **Name of lecturer(s) (provide information as to how, when and where they can be contacted)** | **Department(s)** |
| **Coordinator:****Other lecturer(s):** |  |

**3.**

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| --- | --- |
| **Cycle of Subject** | **Type of course unit** |
| BachelorOr Master  | MandatoryorOptional (elective) |

**4.**

|  |  |  |
| --- | --- | --- |
| **Mode of delivery** | **Year of study and semester when the course unit is delivered** | **Language of instruction** |
| Face-to-faceOr Distance |  |  |

**5.**

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| --- | --- | --- | --- |
| **Number of ECTS credits allocated** | **Student’s workload** | **Contact work hours** | **Independent work hours** |
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**6.**

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|  | **Purpose of the subject:** |
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| **Learning outcomes of the programme** | **Learning outcomes of the subject** | **Teaching and learning methods** | **Assessment methods** |
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**7.**

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|  | **Course contents** |
| **Topics** |  | **Contact work hours and planned learning activities** | **Independent work hours and tasks** |
| Lectures | Consultations | Seminars | Training exercises | Laboratory work | Internship | Assessment | **All contact work hours** | **Independent work hours** | **Tasks** |
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| **Overall** |  |  |  |  |  |  |  |  |  |  |

**8.**

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| **Assessment method** | **Weighting percentage** | **Period or date of assessment** | **Assessment criteria** |
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**9.**

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| **Required reading list** |
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| **Recommended reading list** |
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**Annex 3. Recommended list of subjects**

 Subject Title, Nb of Credits (ECTS)

 Subject Title, Nb of Credits (ECTS)

 Subject Title, Nb of Credits (ECTS)

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**Annex 4. Short presentation of a study programme**

*The below document is a sample extracted from an EU project Tuning regarding Bachelor of Chemical Engineering*

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| BACHELOR OF CHEMICAL ENGINEERINGGENERAL STUDIES |
| Type of degree & length | *Single degree / 240 ECTS (= 8 semesters)* |
| Institution | *Title of HEI: to be completed* |
| Accreditation. Organisations(s) | *Ministry of Education, Department of Accreditation and Nostrification*  |
| Period of Reference | *The study program is validated for x years starting from 2018* |
|  | *QF for EHEA: 1st cycle; EQF level 6**NQF level: 6* |
| **A** | **Purpose** |
|  | The purpose of this bachelor programme is to provide education inChemical Engineering, by considering various types of jobs and careers. Prepare students with a special interest in specialty of Chemical Engineering in pursuit of higher education areas. |
| **B** | **Characteristics** |
| 1 | Discipline(s)/ Subject areas | The main discipline is general physics. The partition is: physics, mathematics, computer science, chemistry, other (50: 18: 8: 7: 17) |
| 2 | General/ Specialist Focus | General education in experimental and theoretical physics. |
| 3 | Orientation | Based on previous research and exposed to current research but with specializations considering opportunities specific to job / career: (subjects of theoretical physics and applied physics) physics, biophysics, medical physics, informatics. |
| 4 | Distinctive Features |  |
| **C** | **Employability and further Education** |
|  | Employability | Positions in companies / businesses and institutions (research / quality assurance, trade) in the areas of technology and Informatics, biomedical and pharmaceutical, the sector of the environment. Positions in financial institutions. Positions in education. |
|  | Further Education | Master's programmes in Physics (theoretical physics, applied physics), interdisciplinary programs related to Physics (Biophysics, medical physics, geophysics), master's programmes in engineering / physics technology or computer science. |
| **D** | **Educational style** |
|  | Learning/ teaching approaches | Lectures, classes of lab, tutorials, individual study based on text books and reading notes, individual consultations with teachers, internship in a research lab on a given topic. |
|  | Assessment method | Written tests, oral tests, lab reports, oral presentations, ongoing evaluation, public presentation and defence of the internship project |
| **E** | **Programme competences** |
| 1 | GENERICThe programme includes the generic competences (or key skills) expected of first cycle graduates. The students should be able to:* Establish their role and mission within an organization to adapt and take initiatives.
* Identify the process of production, dissemination and enhancement of knowledge.
* Respect the principles of ethics, ethical and environmental responsibility.
* Working as part of a team while being independent and responsible with respect to a project.
* Identify the professional fields potentially in relation to the achievements of the bachelor curriculum.
* Characterize and enhance their identity, their skills and their professional project according to a context.
* Able to step back from a situation, self-evaluate and questioning himself in order to improve knowledge

Transverse and language competences* Use digital tools of reference and the rules of computer security to acquire, process, produce and disseminate information as well as to collaborate internally and externally.
* Identify and select various specialized resources to document a subject.
* Analyse and summarize data for their treatment.
* Develop an argument with critical mind.
* Use easily the different registers of written and oral Azeri expression.
* Understand, speak and write currently in at least one foreign language.
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| 2 | SUBJECT SPECIFICWithin the context of the student’s field of professional practice, the graduate is able to demonstrate capability in:* Mobilize the basic concepts in order to: simulate, analyse and solve simple problems
* Address a complex problem and solve it step by step
* Identify the different steps of an experimental approach and perform it.
* Use the measurement devices and measurement techniques commonly used in the lab and in different areas of physics.
* Interpret the experimental data in order to be able to simulate them.
* Probe a model upon comparing its predictions to experimental results and assess its validity range.
* Identify the sources of errors for an experimental result in order to assess its uncertainty range.
* Suggest analogies, estimate orders of magnitude, and be able to understand their meaning.
* Use the main mathematical tools relevant for physics.
* Handle the basic mechanisms at the microscopic scale, simulate the macroscopic phenomena, and make the bridge between macro and micro.
* Make a sound use of some data acquisition and analysis software
* Use an up-to-date programming language
* Identify the currently used techniques in the areas of: fluid mechanics and solid state mechanics, materials science, chemistry, geosciences, thermodynamics and thermal engineering, computer sciences, astronomy / Note: this should be related to each HEIs specific fields, e.g. excellence fields
* Identify the peculiar regulations and implement the main preventive measures regarding health and safety system.
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| **F** | **Programme learning outcomes** |
|  | Within the context of the student’s field of professional practice, the graduate is able to demonstrate capability in:* Knowledge of basic mathematics and related subjects (including mathematical methods for physics; computing; numerical analysis)
* Knowledge of basic physics (introduction to physics; mechanics, vibrations and waves, acoustics, optics, thermodynamics, electromagnetism; quantum physics)
* Knowledge of experimental methods (asking the right questions, measurement theory and treatment of experimental errors, instrumentation) and awareness about professional integrity and how to avoid plagiarism
* Knowledge of basic elements in theoretical physics (analytical mechanics; classical electromagnetism, relativity, etc.; quantum mechanics / theory; statistical physics)
* Knowledge of elements of applied physics and related subjects (chemistry; electronics & related; etc.)
* Knowledge of basic elements in modern physics (atomic, nuclear and sub-nuclear, solid state, astrophysics)
* Small intermediate or final physics project(s)
* Other essential elements, in varying amount depending on the institution (e.g. Knowledge of topics «chosen from list(s)D; presenting a lab report, taking active part in a seminar)
* Some knowledge/abilities in non-standard subjects, in varying amount depending on the institution (e.g. vocational training, skills development, placement, etc.)
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