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**Curriculum**

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| **Program** | **Pharmaceutical Chemistry and Technology** |
| **Degree awarded** | **Bachelor of Science in Chemical and Biological Engineering** |
| **Faculty**  | **Faculty of Technological Engineering** |
| **Program coordinator/coordinators** | **Professor Inga Bochoidze** |
| **Length of the program (semester, ECTS)** |  **240 credits** |
| **Language of the Program**  | **Georgian** |
| **Program development and renewal date of issue** | Developed in May, 2011, accredited – on 16.09.2011, updated – in September 2017  |
| **Program prerequisites** |
| A person with complete general education, who had successfully passed the Unified State Examinations can become a Bachelor student. |
| **Aim of the Program** |
| Chemical and Biological Engineering is a promising growth sector in the world, and development of this sector in the context of the area of Pharmaceutical Technology is even more relevant today. The most important task of modern pharmaceutical science is the production of safe, ecologically pure preparations with no side effects. To that end, special attention is attracted by natural therapeutic raw materials, since they are not characterized by those shortcomings, which are typical of many synthetic therapeutic remedies. Unique raw material resources of Georgia give reason for the development in this context, and the country’s traditions in this regard are in the process of revival. The pharmaceutical corporations and companies are being created in Georgia, which produce their own products and are oriented towards both Georgian and international markets. New jobs were created in the country, as did the demand for highly-qualified specialists. **Program is aimed** at training of competitive and highly-qualified specialists in the field of pharmaceutical preparations chemistry and technology; providing students with fundamental education in chemical and biological sciences; ensuring their academic and career progression; training of Bachelors of chemical and biological engineering, who are expected to have analytical thinking and decision-making skills, and who, within their competence, are expected to be able to: * carry out chemical analysis and synthesis of biologically active substances, as well as develop and organize technology for processing therapeutic raw materials;
* produce chemical, pharmaceutical and cosmetic products and therapeutic dosage forms, select technological processes and technological equipment, including their proper arrangement and safe operation;
* determine of main indicators of enterprsies manufacturing pharmaceutical and perfume-cosmetic products, carry out marketing research of chemical and pharmaceutical goods, and manage structural units of pharmaceutical organizations and institutions;
* provide control of the quality of therapeutic remedies and therapeutic raw materials at the stages of their processing, obtaining, use and storage, studies and control of pharmaceutical products in accordance with international standards and requirements.
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| **Learning outcomes (the map of competences - see attached document 2)** |
| **Knowledge and understanding** | After the completion of the program, a graduate is expected to acquire profound knowledge in those basic and special disciplines, which are envisaged in Bachelor program. Bachelors are expected to know: chemical composition of therapeutic preparations; main methods of carrying out the experiments; main areas of chemical and biological technologies; technologies for producing and storage of pharmaceutical, perfume and cosmetic products; main technological processes and equipment of pharmaceutical production; methods of quality assessment of pharmaceutical products.They are also expected to understand: the need for safety and workplace hygiene proceeding from the specificity of branch; the influence engineering solutions on economic, environmental and social factors; the role, importance and prospects of the development of pharmaceutical production in the country’s economic development.  |
| **Applying knowledge** | After the completion of the program, a graduate is expected to: carry out practical activities in chemical, biological and pharmaceutical enterprises, and other organizations of the appropriate sector; have opportunity to use methods, innovations and modern means in chemical and pharmaceutical engineering practices. The graduates are also expected to be able to:- design and conduct the experiment in accordance with previously defined guidelines;- develop systems, elements or processes taking into account technology and stability, economic, environmental, health and safety factors;- prepare technological scheme of raw materials processing and calculate main indicators;- assess the quality of chemical, pharmaceutical and cosmetic products;- identify, formulate and address technical problems.  |
| **Making judgement** | After the completion of the program, a graduate is expected to be able: - to analyze and compare data for addressing various branch problems, and make well-grounded conclusions; study and analyze the possibilities of using new methods and means in chemical and pharmaceutical technologies. As a result, Bachelors are expected: to generalize advanced ideas and modern technologies in the context of chemical and biological technologies taking into account the experience of developed countries (with account for technological, economic, administrative and legal factors), which will be supported with the relevant arguments.  |
| **Communication skills** | After the completion of the program, the graduates are expected to: have capacity and opportunity for the effective correspondence in writing and orally; be able to draft academically proper written and electronic correspondences. A good command of foreign language is required for both fluent communications with foreign partners and familiarizing with appropriate literary sources. Proceeding from the specificity of branch, they are also expected to be able: to communicate in Latin language; to familiarize themselves with regulatory conditions of technology, quality control and storage of therapeutic preparations, study and process the normative documentation.  |
| **Learning skills** | After the completion of the program, a graduate is expected: to take into account advanced ideas for receiving academic education, including at the next higher education level; have capacity to assess his/her own knowledge and determine the need for continuing studies, as well as to update knowledge. The graduates are also expected: to have a clear understanding of specialties and areas of branch that will allow them for defining the area, in which they want to improve their knowledge at the next educational level.  |
| **Values** | After the completion of the program, a graduate is expected: to recognize great professional, ethical and legislative responsibility; to have regard for existing values and take part in the formation of new ones; to observe the principles of efficiency, safety, quality and accessibility during preparing and producing pharmaceutical preparations.  |
| **Teaching methods** |
| Teaching is a bilateral activity, and process, which implemented by both sides professor and student, particularly transfer of knowledge (Professor, teacher) and acquisition of knowledge (student).Student’s activities include: * attendance of lectures;
* laboratory works;
* practical exercises;
* individual studies;
* practical training;
* work experience internship;
* taking of examinations.

The following teaching methods are used during lecture studies: explanatory method, demonstrative method, case study, problem-based learning, discussion; In practical exercises: explanatory method, discussion, action-oriented method, writing method, collaborative work, cooperative method;For individual studies, there are used bookwork method, writing method, heuristic and electronic methods. 1. Explanatory method - is based on discussion around the given issue, while transferring material, professor is giving a concrete example that is discussed in detail in the frame of given topic;
2. Demonstrative method involves visual presentation of information. In terms of achieving outcomes, this method is very effective. In most cases, it is desirable to transfer educational content to students through electro-technical action and visually simultaneously. Demonstration of educational content can be carried out by both teacher and student.
3. Case study - involves reviewing specific cases together with students during the classes, and they study problem comprehensively and thoroughly.
4. Discussion/debates – one of the most common methods of interactive training. The process of discussion increases considerably the level of involvement of students. This process is not limited merely to questions asked by professor. This method develops capacity of students to express actively the acquired knowledge and engage intensively in a teamwork process, make presentations, offer a strong defence of their own positions.
5. Problem-based learning(PBL) is a method, which uses the problem as an initial stage of acquision of knowledge and integration process

6. Collaborative work–this method involves dividing groups and giving tasks to them, the members of the group individually think about issue and share information with other members. Proceeding from the goal set, there is a possibility to share functions among the members during the process of study that provides maximum involvement of all students in the process of study. 7. Cooperative teaching – is such teaching strategy, where every member is required not only to study, but also to help his/her teammate to better study the subject. Every group member works on problem before all of them have learnt the subject. 8. Heuristic method – is based on stage-by-stage solving of problem by students. 9. Action-oriented teaching requires active attraction of student and professor in the process of study, where practical interpretation of theoretical material is of particular importance 10. Induction, deduction, analysis and synthesis. - Inductive method of teaching involves the train of thought during the training process from private (concrete) facts to their generalization, that is, the process during the transfer of knowledge, moves from the general to the particular - Deductive method of teaching is such tool of the transfer of knowledge, which is based on a general knowledge, is a logical process of the expression of a new knowledge, that is, management of the course of process from the general to the particular- Method of analysisinvolves breaking down the educational materials as a complex topic into the component parts that simplifies detailed elaboration on the individual issues existing inside the stated problemპ - Method of synthesisinvolves creating the perception of a complex topic by bringing together the individual issues. This method contributes to the development of the ability to see the entire. 11. Electronic method (e-learning) – this method involves three types of studying: - Intramural studies, when training process is moving within the framework of contact hours between professor and students, and the transfer of the educational content is carried out by means of the electronic course; - Hybrid (intramural/distant) studies, the most part of which is carried out remotely, and a small part is moving within the framework of contact hours. - Completely distant learning involves conduction of training process without physical presence of professor, and training course is carried out remotely from beginning to end, in an electronic format. Proceeding from the specificity ofthe training course, teacher uses appropriate teaching method.  |
| **Structure of the Program** |
| The basic compulsory courses – 210 credits, faculty elective courses – 15 credits, specialty elective courses – 15 credits. **see attached document 1** |
| **Assessment System** |
| The assessment system of the academic performance of students in higher education programs is in compliance with the Order of the Minister of Education and Science of Georgia of 5 January 2007 No 3 “On approving the calculation rules of credits for higher education programs” (as at 1 September 2016). The students grading scheme includes, a) five types of positive assessment:(A) Excellent – 91-100 points. (B) Very good – 81-90 points.  (C) Good – 71-80 points.  (D) Satisfactory – 61-70 points. (E) Acceptable – 51-60 points. b) two types of negative assessment:(FX) Student could not pass examination – 41-50 point that means that she/he is required to work more for passing the exam, and that s/he is entitled to retake exam only once after individual work;(F) failed to pass –40 points and lower that means that the work done by student is not sufficient and she/he has to redo the course. Within the training component of educational program, in case of FX assessment, a makeup exam is appointed no later than 5 days since the announcement of the examination results.Maximum course assessment score is 100 points.The assessment of the academic performance of student in each course consists of the interim and final assessments, of which the conclusive one is a Final Examination. The maximum score for final examination is 40 points. Student has the right to take the final exam, if his/her minimum assessment score at mid-term examination is 18 points. The number of points received in a makeup examination is a final assessment score and is not added to the final assessment received by student, and it will be reflected in final assessment of the training component. With account for the assessment received in the educational component, in case of final assessment score 0-50 points, student is assessed at F-0 point. The assessment schemes for each particular course are given in syllabuses presented in annexes to this Program.  |
| **Employment opportunities** |
| Bachelor graduates can work for the industrial enterprises and companies for the production of chemical, pharmaceutical and cosmetic preparations in various positions. Bachelor’s sectors of employment are as follows: • chemical and pharmaceutical enterprises, corporations and companies; • network of pharmacies;• research institutions of a corresponding profile; • vocational training institutions; • pharmaceutical products certification, standardization and quality control authorities.  If desired, a graduate can continue education at Master courses.  |
| **Supportive resources**  |
| 1. University classrooms;2. A constantly updating book collection of the University’s scientific and technical library;3. Auxiliary resource materials created by the University’s teaching staff;4. Chemical technology training laboratories;5. A library of the Faculty of Technological Engineering and Department of Chemical Technologies;6**.**  Computer centers equipped with modern technologies**;** the opportunity of visiting, reviewing and analyzing the Internet websites for all interested students;7**.**  Lecture and practical training rooms provided with equipment appropriate with modern multimedia training**.**   |
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**Attachment 1.**

**Akaki Tsereteli State University**

**Faculty of Technological Engineering**

**Bachelor Program**

**Pharmaceutical Chemistry and Technology**

**Study Schedule 2017-2021**

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| --- | --- | --- | --- |
| **Training courses/ modules** | **Semesters**  | **Number of hours** |  **Total**  |
| **Contact hours** | **Independent**  |
| **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **Lecture** | **Pract./group** | **Laborat.** | **Mid-term and fin. exam** |
| 1. Foreign Language 1 | 5 |  |  |  |  |  |  |  |  | 60 |  | 3 | 62 | 125 |
| 2. Foreign Language 2 |  | 5 |  |  |  |  |  |  |  | 60 |  | 3 | 62 | 125 |
| 3. Foreign Language 3 |  |  | 5 |  |  |  |  |  |  | 60 |  | 3 | 62 | 125 |
| 4. Higher Mathematics 1  | 5 |  |  |  |  |  |  |  | 15 | 60 |  | 3 | 47 | 125 |
| 5. Higher Mathematics 2 |  | 5 |  |  |  |  |  |  | 15 | 60 |  | 3 | 47 | 125 |
| 6. Information Science and Information Technology  | 5 |  |  |  |  |  |  |  |  | 30 |  | 3 | 92 | 125 |
| 7. Physics |  | 5 |  |  |  |  |  |  | 15 | 15 | 15 | 3 | 77 | 125 |
| 8. General Biology | 5 |  |  |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 9. Botany  |  | 5 |  |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 10. General and Inorganic Chemistry - 1  | 5 |  |  |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 11. General and Inorganic Chemistry - 2 |  | 5 |  |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 12. Organic and High Molecular Compounds Chemistry -1 |  |  | 5 |  |  |  |  |  | 15 |  | 60 | 3 | 47 | 125 |
| 13. Organic and High Molecular Compounds Chemistry -2 |  |  |  | 5 |  |  |  |  | 15 |  | 60 | 3 | 47 | 125 |
| 14. General Chemical Engineering  |  |  | 5 |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 15. Physical-Colloidal Chemistry  |  |  | 5 |  |  |  |  |  | 15 | 15 | 15 | 3 | 77 | 125 |
| 16. Applied Mechanics  |  |  |  | 5 |  |  |  |  | 15 | 15 | 15 | 3 | 77 | 125 |
| 17. Engineering Graphics  | 5 |  |  |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 18. Analytical Chemistry  |  |  |  | 5 |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 19. Measurements and Standards  |  |  |  |  | 5 |  |  |  | 15 | 15 | 15 | 3 | 77 | 125 |
| 20. Electrical Engineering and Fundamentals of Electronics |  |  |  |  | 5 |  |  |  | 15 | 15 | 15 | 3 | 77 | 125 |
| 21. Practical Training  |  |  |  | 5 |  |  |  |  |  | 100 |  | 3 | 22 | 125 |
| **Faculty elective courses** (15 credits) |  | **5** | **5** | **5** |  |  |  |  |  |  |  |  |  |  |
| 1.1. Georgian stylistics and speech culture  |  | 5 |  |  |  |  |  |  |  | 45 |  | 3 | 77 | 125 |
| 1.2. Philosophy  |  | 5 |  |  |  |  |  |  | 30 | 15 |  | 3 | 77 | 125 |
| 2.1. History of Georgia |  |  | 5 |  |  |  |  |  | 30 | 15 |  | 3 | 77 | 125 |
| 2.2. Political Science  |  |  | 5 |  |  |  |  |  | 30 | 15 |  | 3 | 77 | 125 |
| 1.3. Second foreign language - 1 |  | 5 |  |  |  |  |  |  |  | 60 |  | 3 | 62 | 125 |
| 2.3. Second foreign language - 2 |  |  | 5 |  |  |  |  |  |  | 60 |  | 3 | 62 | 125 |
| 3.3. Second foreign language - 3 |  |  |  | 5 |  |  |  |  |  | 60 |  | 3 | 62 | 125 |
| 3.1. First aid training course  |  |  |  | 5 |  |  |  |  | 15 | 30 |  | 3 | 77 | 125 |
| 3.2. Emergency Situations and Civil Defense  |  |  |  | 5 |  |  |  |  | 30 | 15 |  | 3 | 77 | 125 |

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| **Training courses/ modules**  | **Semesters**  | **Number of hours** |  **Total** |
| **Contact hours** | **Independent**  |
| **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | **Lecture** | **Pract./group** | **Laborat.** | **Mid-term and fin. exam** |
| 1.1. Pharmaceutical Chemistry -1  |  |  |  |  | 5 |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.2. Pharmaceutical Chemistry -2 |  |  |  |  |  | 5 |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.3. Toxicological Chemistry  |  |  |  |  |  |  | 5 |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.4. Foundations of Pharmacology  |  |  |  |  |  |  |  | 5 | 15 |  | 30 | 3 | 77 | 125 |
| 1.5. Human Anatomy. Physiology.  |  |  | 5 |  |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.6. Pharmacognosy |  |  |  | 5 |  |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.7. Therapeutic Microbiology, Virology, Immunology  |  |  |  |  |  |  | 5 |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.8. Synthesis of Therapeutic Agents  |  |  |  |  | 7 |  |  |  | 15 |  | 60 | 3 | 97 | 175 |
| 1.9. Pharmaceutical Production Processes and Devices  |  |  |  |  |  | 5 |  |  | 15 | 30 |  | 3 | 77 | 125 |
| 1.10. Chemistry and Technology of Biologically Active Substances -1  |  |  |  |  |  | 5 |  |  | 15 |  | 30 | 3 | 775ეფასებადა საბოლოო შეფას | 125 |
| 1.11. Chemistry and Technology of Biologically Active Substances -2 |  |  |  |  |  |  | 5 |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.111. Biotechnology  |  |  |  |  |  |  |  | 5 | 15 | 30 |  | 3 | 77 | 125 |
| 1.12. Dosage Forms Pharmaceutical Technology  |  |  |  |  |  | 5 |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.13. Dosage Forms Factory Technology -1 |  |  |  |  |  |  | 5 |  | 15 |  | 30 | 3 | 77 | 125 |
| 1.14. . Dosage Forms Factory Technology -2 |  |  |  |  |  |  |  | 5 | 15 |  | 30 | 3 | 77 | 125 |
| 1.15. Technology of Perfume and Cosmetic Products  |  |  |  |  |  |  |  | 5 | 15 |  | 30 | 3 | 77 | 125 |
| 1.16. Latin Language and Terminology  |  |  |  |  | 3 |  |  |  |  | 45 |  | 3 | 27 | 75 |
| 1.17. Applied Ecology  |  |  |  |  |  | 5 |  |  | 15 | 30 |  | 3 | 77 | 125 |
| 1.18. Pharmacoeconomics (Principles of Management and Marketing)  |  |  |  |  |  |  | 5 |  | 15 | 30 |  | 3 | 77 | 125 |
| 1.19. Commodity Science and Expertise of Pharmaceutical Preparations  |  |  |  |  |  |  |  | 5 | 15 |  | 60 | 3 | 47 | 125 |
| **Elective (15 credits):** |  |  |  |  | **5** |  | **5** | **5** |  |  |  |  |  |  |
| * 1. Biophysics
 |  |  |  |  | 5 |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| * 1. Biochemistry
 |  |  |  |  | 5 |  |  |  | 15 |  | 30 | 3 | 77 | 125 |
| 2. 3. Social Pharmacy  |  |  |  |  |  |  | 5 |  | 15 | 30 |  | 3 | 77 | 125 |
| 2.4. History of the Development of Pharmaceutical Technologies  |  |  |  |  |  |  | 5 |  | 15 | 30 |  | 3 | 77 | 125 |
| 2.5. Life safety and Occupational Hygiene  |  |  |  |  |  |  |  | 5 | 15 | 30 |  | 3 | 77 | 125 |
| 2.6. Engineering Technologies – Logical and Quantitative Proposition  |  |  |  |  |  |  |  | 5 |  | 45 |  | 3 | 77 | 125 |
| Work Experience Internship  |  |  |  |  |  | 5 |  |  | 50 | 3 | 72 | 125 |
| Total  | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** |  |  |  |  |  |  |
| **240** |  |  |  |  |  | **6000** |