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**Curriculum**

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| **Program** | | **Applied Biosciences (Biotechnology)** | |
| **Degree awarded** | | **Bachelor of Science (BSc) in Applied Biosciences** | |
| **Faculty** | | **Faculty of Exact and Natural Sciences** | |
| **Program coordinator/coordinators** | | **Ketevan Chikvinidze** – Associate Professor, PhD | |
| **Length of the program (semester, ECTS)** | | **4 year / 8 semesters / 240 credits**  Basic (Major) Programme – 180 cr.  Minor Program/Free credits – 60 cr. | |
| **Language of the Program** | | | **Georgian** |
| **Program development and renewal date of issue** | | | The Accreditation Decision #41, 23.09.2011  Faculty of Exact and Natural Sciences Board protocol №7; 25.04.2011  Academic Board protocol №1 (11/12) 31.08.2011;  Faculty Board Protocol #8, 24.05.2012  Academic Board protocol #17, 25.05.2012  Faculty Board Protocol #3, 16.05.2014  Faculty Board Protocol #12, 15.06.2016  Academic Board protocol #2, (15/16) 22.09.2016  Faculty Board Protocol #1, 11.09.2017  Academic Board protocol #1 (17/18) 15.09.2017 |
| **Program prerequisites** | | | |
| **-** Certificate of General Education issued by the State;  **-**  Certificate of confirmation of passing the unified national exams (in GAT, Georgian, Foreign Language and any of natural science disciplines: Physics, Chemistry, and Biology) | | | |
| **Aim of the Program** | | | |
| The program aims at   * providing a student with: a) wide scope of knowledge in molecular and biochemical basis of biological processes, and b)   basic theoretical and practical knowledge in the fields of bioscience and biotechnologies;   * developing skills of conducting qualitative and quantitative analysis with respect to bio systems; * introducing approaches and technologies used in solving biological problems; * developing skills of applying knowledge into practice; * developing practical skills in applying communication and information technologies; in project drafting and planning, in working in a group and individually; in problem analysis and their potential optimal resolution search and realization; * providing a student with knowledge and experience valid for employment opportunities at the related educational scientific enterprises as well as at the organizations where graduates can demonstrate their general aptitude, and for graduate studies after the program completion; * ensuring the implementation of the course that meets the standards of ATSU Office of Quality Insurance and award students with bachelor degree certificate complying the standards approved by the Ministry of Education and Science of Georgia. | | | |
| **Learning outcomes (the map of competences):** See Appendix 2 | | | |
| **Knowledge and understanding** | A student will acquire:   * Basic theoretical and practical education in bioscience and biotechnologies; * Structural and functional Knowledge of animals and plants, also theoretical basis and applied disciplines of biotechnology; practical skills of work at chemical and biological laboratories; * Understanding of professional responsibilities and ethics. The practice oriented on employment will develop skills of working, independent problem-solving, time management and optimal organizing; * Knowledge of major principles and concepts of the fundaments of natural (Chemistry/Physics) and the assisting exact sciences (Mathematics; IT and Computer); * Wide knowledge of fundamental disciplines of biology (cellular biology, genetics, molecular biology, general physiology and etc.); * Knowledge of fundamental disciplines of biology (biochemistry, microbiology, virology, biotechnology, scientific research modelling and etc.); * Deep knowledge and understanding of field issues of different disciplines of applied bioscience, food biotechnology, environmental biotechnology, healthcare biotechnology. | | |
| **Applying knowledge** | * Ability to conduct studies independently and in group by employing contemporary methods and approaches ; * Ability to work in the research laboratory; * Ability to plan and implement practical work by employing standard methods of bioscience; * Ability to implement laboratory assignment initiated by the teacher, and to predict possible outcomes; * Ability to conduct quantitative analysis (including statistics); * Ability to use computer programs to elaborate data | | |
| **Making judgement** | After the completion of the program, the graduate will have:   * Ability to categorize, analyze and evaluate contemporary scientific achievements in bioscience and biotechnology; * Ability to carry comparative analysis of scientific, social (ethical) and environmental aspects of applied biology; * Ability to relate the knowledge of fundamental natural studies with major aspects of applied bioscience and biotechnology. | | |
| **Communication skills** | A student will be   * Communicating effectively orally and in written form with colleagues and academic personnel on professional issues; * Able to demonstrate personal achievements in the form of portfolio; * Able to write and design scientific article for conferences; to know structure and vocabulary; * Able to draw conclusions and arguments and introduce to the audience; participate in the discussions; * Creatively using modern IT and computer in applied biology. | | |
| **Learning skills** | A student will have:   * Ability to plan and implement studies of natural science disciplines and certain fields of applied bioscience from various resources (reference literature, audio and video material, internet resources); * Ability to work independently to solve certain problem or its component; * Ability to assess available resources and use them in learning; * Ability of self-criticism and self-development. | | |
| **Values** | A student will have:   * Ability to evaluate his/her own and others perception of values; * Ability to participate in the establishment of values; * Ability to evaluate ethical values in solving a bioethical problem. | | |
| **Teaching methods** | | | |
| *From traditional teaching methods we offer:* induction, deduction analysis and synthesis; verbal/explanatory method – discussion around the issue; writhing – thesis or essay, notes, records etc.; heuristic method - a step-by-step problem solution. It is implemented through independently adressing facts and identifying links between them in the learning process. Demonstrative method – visual presentation of information. From the standpoint of reaching result, it is quite effective, demonstration of material to be studied is possible by teacher and student as well. This method helps us to make the perception of different stage of educational material more significant. Say concretely, what student should do all alone. Demonstration may carry simple image or take such difficult face as carrying out multistep experiment; research method –student participates in the research process under the guidance of the teacher, identifies research object, methods ( qualitative, quantitative, statistical, comparative analysis method and/or their combination); works on the resources, approaches and comes to certain conclusions; independent study – each student works independently to solve the problem set by the instructor, and is responsible for the given assignment. The task should be implemented in due time as quality and time management are equally important.  *Interactive Methods of Teaching:* Problem based lecture– an instructor posts problematic situation at the start of the lecture and engages students into the process of analysis. By discussing and later solving controversies, students arrive at the conclusions which are new knowledge; engaging class – after introducing the issue, the educator tells the students that there will be deliberate mistakes in content, methods, behavior and etc. When the class is finishing the students should list those mistakes; lecture-visualization – class contains visual information (slide-show, video, scheme, diagram, table, map and etc.); lecture-press conference – educator asks students to write questions they want to know answers to. This should take 2 to 3 minutes. Then, for 5 minutes the educator makes system of contents for the questions and starts the class which includes answers to the questions; lecture-dialogue – the education explains the content through the series of questions which students have to answer during the session; discussion – open discussion or the exchange of knowledge, arguments, and ideas around the problem. The discussion ensures active, deep and individual perception of knowledge. while lecture is the most “frugal” way of sharing knowledge, discussion is with rather long-lasting effect. Active, motivated and emotional discussion, opposing and arguing enables student to acquire knowledge meaningfully, and at the same time, understand and care about knowledge updating; brain-storming – the freest form of discussion providing quick and equal engagement of all members into the process of problem discussion. They share their ideas which the educator informally evaluates positively. Then, through critical analysis and evaluation some positions and ideas are generated and selected. Thus, there is a key to the task/problem/issue identified by the majority of students in a group; collaborative method – students divide up into groups and they are given tasks. the members of the group individually think about issue and share information with other members. Due to the goal set there is possibility to share functions among the members during the process of study that provides maximum engagement of all students in the process of study; PBL – problem is an inception to new knowledge acquisition and integration process. Students set a “Problem Tree” and make primary and secondary problem selection, and look for solutions which are illustrated in a “Goal Tree” with goals of primary and secondary importance.  Role Playing and Situations–role playing scenarios allow students to view the issue from different angles and help them form alternative views. Like discussion role playing provide a student with the skills of independently expressing his/her own position and defending it in a debate; Action Oriented Learning (AOL) - demands active participation of a student and a professor in the process of study, where practical interpretation of theoretical material takes special loadings.  Major forms of teaching are lectures with practical and laboratory sessions and seminars. Students develop general aptitudes through specific courses as well as through field modules. Special attention is paid to the development of cognitive skills provided by the teaching of modules that cover practical sessions, group discussions and presentations. Class attendance, intensive communication with educators and curators assist students to develop practical skills. Final year includes practical training in enterprises that also contributes to gaining experience in the sphere of science/industry. The development of reporting skills is an outcome of the reports and presentations that follow practical training in enterprises.  The development of communication skills is the result of seminars and presentations, practical training and reporting. Learning skills will enhance through independent work, midterm exams and colloquiums, through interaction with educators and curators, and through the choice of optional modules.  Throughout the program students are encouraged to search for additional resources for self-education. Students should use press and internet resources indicated by the teacher. Critical evaluation of information and experimental data, as well as logical argumentation are encourages throughout four years of program span. | | | |
| **Structure of the Program** | | | |
| **4 year / 8 semester / 15 weeks per semester**  The program covers 180 credits of major and 60 credits of minor courses equaling a total of 240 credits. Major course combines: compulsory university courses (15 credits), elective faculty courses (20 credits), compulsory courses of specialization (125 credits) and elective specialization courses (55 credits); In semester VIII student takes practical training at the enterprise (15 credits).  **Credit Table:**   |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | **Program Components** | | | | | | | | | | | |  | | **ECTS** | **I** | **II** | **III** | **IV** | **V** | **VI** | **VII** | **VIII** | | **University Compulsory courses (Foreign Language)** | | **15** | **5** | **5** | **5** |  |  |  |  |  | | **Faculty Courses** | Compulsory | **10** | **10** |  |  |  |  |  |  |  | | Elective | **10** | **15** |  |  |  |  |  |  |  | | **Specialization Courses** | Compulsory | **70** |  | **25** | **15** | **20** | **10** | **10** | **10** |  | | Elective | **50** |  |  |  |  | **10** | **10** | **10** | **5** | | Professional Practice (Practical Training) | | **15** |  |  |  |  |  |  |  | **15** | | Minor Credits | | **60** |  |  | **10** | **10** | **10** | **10** | **10** | **10** | | **Total** | | **240** | **30** | **30** | **30** | **30** | **30** | **30** | **30** | **30** |   **See Appendix 1** | | | |
| **Assessment System** | | | |
| Students are assessed through written exam (test, closed questions, problem solving and etc.) and midterm work (topics, laboratory report, oral and poster presentations). Cognitive skills are assessed throughout entire degree program (Laboratory work, course work, final exam); Practical skills are assessed via laboratory reporting; communication skills are assessed within different modules (course work, opal and poster presentation, reports, final exam).  Students get credits after they accomplish learning outcomes planned in the curriculum.  The student must not be assessed only on the basis of the final exam. The assessment should include:   1. Midterm exam; 2. Final exam.   Final assessment of a student is obtained from the add-up of mid-term and final exams throughout the semester. The educational course has a grading scale of 100 points. The student has the right to take the final exam, if his/her minimum competency equals 18 points.Minimum margin of assessment received by the student on the final exam is 15 points. Below than this, is assessed with FX (fail).  Evaluation System includes:  A. Five Forms 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) sufficient – 51-60 points  B. Two Forms of Negative Assessment:  (FX) (Administrative Fail in Course for Grade/could not pass) – A student gets 41-50 points from maximum evaluation which means that s/he is required to work more for passing the exam, and that s/he is entitled to take a make-up exam only once through personal study  (F) (Academic Fail) – A student gets 0 – 40 points from maximum evaluation; it means that the work done by him/her is not sufficient and she/he has to retake the course.  According to educational component of educational program, in case of adoption of FX, a makeup exam will be appointed no less than 5 calendar days after the conclusion of the final exam results.  The number of points received in the make-up final exam, is not added to the final assessment received by the student.  According to the assessment 0-50 points received from the make-up final exam, in the final evaluation of the educational component, the student will receive a grade of F-0.  (Midterm and final exams take place in exam center of ATSU)  Specific assessment criteria are outlined in the syllabus of the relevant academic course. | | | |
| **Employment opportunities** | | | |
| Applied Bioscience (Biotechnology) bachelors have wide range of employment possibilities; they can work in:   * the relevant field laboratories of clinical, diagnostic, scientific and research institutions; * diagnostic centers of the ministries of Internal Affairs and Justice; * Expertise Services; * Environmental Protection and Monitoring Services; * Research and counselling services; * Sanitary and Environmental Security Services; * Pharmacological and pharmaceutical enterprises; * Food production and private agricultural companies; * the enterprises where complex knowledge of methods and approaches of fundamental and applied branches is essential   Graduates can apply to Master’s degree in applied bioscience and biotechnology, biology, food production, pharmaceutics, toxicology and other adjacent disciplines. | | | |
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**Curriculum 2017-2021**

**Programme: Applied Bioscience (Biotechnology)**

**Qualification: Bachelor of Science in Bioscience (BSc in Applied Bioscience)**

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| № | Course | Contact hrs. per week | Credit Number | The number of hours | | | | Lectures/practical/group work/laboratory | Semester | | | | | | | | Precondition |
| Total | Contact | | Independent | I | II | III | IV | V | VI | VII | VIII |
| Auditory | Midterm and final exam |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
| **1** | **University Compulsory (15 ECTS)** | | | | | | | | | | | | | | | | |
| 1.1 | Foreign Language-1 | 3 | 5 | 125 | 60 | 3 | 62 | 0/3/0/0 | 5 |  |  |  |  |  |  |  | - |
| 1.2 | Foreign Language -2 | 3 | 5 | 125 | 60 | 3 | 62 | 0/3/0/0 |  | 5 |  |  |  |  |  |  | 1.1 |
| 1.3 | Foreign Language -3 | 3 | 5 | 125 | 60 | 3 | 62 | 0/3/0/0 |  |  | 5 |  |  |  |  |  | 1.2 |
| **2** | **Faculty Compulsory Courses (10 ECTS)** | | | | | | | | | | | | | | | | |
| 2.1 | Calculus | 4 | 5 | 125 | 60 | 3 | 62 | 2/2/0/0 | 5 |  |  |  |  |  |  |  | - |
| 2.2 | Computer Skills | 4 | 5 | 125 | 60 | 3 | 62 | 2/0/2/0 | 5 |  |  |  |  |  |  |  | - |
| **3** | **Faculty Elective Courses (15 ECTS – 3 courses)** | | | | | | | | | | | | | | | | |
| 3.1 | Introduction to Chemistry | 3 | 5 | 125 | 45 | 3 | 77 | 2/0/1/0 | 5 |  |  |  |  |  |  |  | - |
| 3.2 | Introduction to Physics | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 | 5 |  |  |  |  |  |  |  | - |
| 3.3 | Introduction to Biology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 | 5 |  |  |  |  |  |  |  | - |
| 3.4 | Introduction to Geography | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 | 5 |  |  |  |  |  |  |  | - |
| 3.5 | Math Analysis | 4 | 5 | 125 | 60 | 3 | 62 | 2/2/0/0 |  |  |  |  |  |  |  |  |  |
| 3.6 | Basics of Programming | 3 | 5 | 125 | 45 | 3 | 77 | 1/1/1/0 | 5 |  |  |  |  |  |  |  | - |
| **4** | **Specialization Compulsory Courses ( 90ECTS)** | | | | | | | | | | | | | | | | |
| 4.1 | Cell Biology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  | 5 |  |  |  |  |  |  | 3.3 |
| 4.2 | Biochemistry I | 3 | 5 | 125 | 45 | 3 | 77 | 1/1/1/0 |  | 5 |  |  |  |  |  |  | 3.1 |
| 4.3 | Biodiversity I (Plants) | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  | 5 |  |  |  |  |  |  | 3.3 |
| 4.4 | Biodiversity II | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  | 5 |  |  |  |  |  |  | 3.3 |
| 4.5 | Human Morphology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  | 5 |  |  |  |  |  |  | - |
| 4.6 | Genetics and Molecular Biology I | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  | 5 |  |  |  |  |  | 4.2 |
| 4.7 | Biochemistry II (Metabolic Biochemistry) | 3 | 5 | 125 | 45 | 3 | 77 | 1/1/1/0 |  |  | 5 |  |  |  |  |  | 4.2 |
| 4.8 | Microbiology and Virology | 3 | 5 | 125 | 45 | 3 | 77 | 1/1/1/0 |  |  | 5 |  |  |  |  |  | 4.1 |
| 4.9 | General Physiology I (Plants) | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  | 5 |  |  |  |  | 4.3 |
| 4.10 | General Physiology II Humans and animals) | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  | 5 |  |  |  |  | 4.4 |
| 4.11 | Genetics and Molecular Biology II | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  | 5 |  |  |  |  | 4.6 |
| 4.12 | Biophysics | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  | 5 |  |  |  |  | 4.7 |
| 4.13 | Science Research Modelling | 3 | 5 | 125 | 45 | 3 | 77 | 1/2/0/0 |  |  |  |  | 5 |  |  |  | 4.12 |
| 4.14 | Basics of Laboratory Studies | 3 | 5 | 125 | 45 | 3 | 77 | 1/0/2/0 |  |  |  |  | 5 |  |  |  | 4.7 |
| 4.15 | Biotechnology | 6 | 10 | 250 | 90 | 3 | 157 | 3/3/0/0 |  |  |  |  |  | 10 |  |  | 4.11 |
| 4.16 | Laboratory Research methods in Biotechnology | 4 | 5 | 125 | 60 | 3 | 62 | 1/1/2/0 |  |  |  |  |  |  | 5 |  | 4.14 |
| 4.17 | Waste Management and Biotechnology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  | 5 |  | - |
| **Total** | | **90** | **130** | **3625** | **1350** | **87** | **2188** | **90** |  | | | | | | | |  |
| **5** | **Specialization Elective Modules (35 ECTS)** | | | | | | | | | | | | | | | | |
| **Elective Module I** | | **6** | **10** |  |  |  |  |  |  |  |  |  | **10** |  |  |  |  |
| 5.1.1 | Human Ontogenesis | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.5 |
| 5.1.2 | Medical Microbiology and Virology | 3 | 5 | 125 | 45 | 3 | 77 | 1/1/1/0 |  |  |  |  |  |  |  | 4.8 |
| 5.1.3 | Cell Signaling Systems | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.12 |
| 5.1.4 | Ecology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.4 |
| **Total:** | | **6** | **10** | **250** | **90** | **6** | **154** | **6** |  | | | | | | | | |
| **Elective Module II** | | **6** | **10** |  |  |  |  |  |  |  |  |  |  | **10** |  |  |  |
| 5.2.1 | Medical Ecology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.12 |
| 5.2.2 | Environmental Monitoring | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.13 |
| 5.2.3 | Fundamental Technologies | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.7 |
| 5.2.4 | Immunology and Immune Diagnostics | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.11 |
| **Total:** | | **6** | **10** | **250** | **90** | **6** | **154** | **6** |  | | | | | | | | |
| **Elective Module III** | | **6** | **10** |  |  |  |  |  |  |  |  |  |  |  | **10** |  |  |
| 5.3.1 | Bio Conservation and Protected Areas | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.3 |
| 5.3.2 | Bio Ethics | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.15 |
| 5.3.3 | Cellular and Genetic Pathology | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.11 |
| 5.3.4 | Introduction to Environmental Protection | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.4 |
| 5.3.5 | Food and Health | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.10 |
| 5.3.6 | Human and Environment | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.9 |
| **Total** | | **6** | **10** | **250** | **90** | **6** | **154** | **6** |  | | | | | | | | |
| **Elective Module IV** | | **3** | **5** |  |  |  |  |  |  |  |  |  |  |  |  | **5** |  |
| 5.4.1 | Genetically Modified Products | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.6 |
| 5.4.2 | Principles of Healthcare Management | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.15 |
| 5.4.3 | Environmental Management and Accompanying Services | 3 | 5 | 125 | 45 | 3 | 77 | 2/1/0/0 |  |  |  |  |  |  |  | 4.15 |
| **Total:** | | **3** | **5** | **125** | **45** | **3** | **77** | **3** |  |  |  |  |  |  |  |  |  |
| **Overall Total** | | **111** | **165** | **4500** | **1665** | **108** | **2727** | **111** |  |  |  |  |  |  |  |  |  |
| **6.** | **Professional Practice in the Industry (15 ECTS)** | | | | | | | | | | | | | | | | |
|  | Professional Practice |  | **15** |  |  |  |  |  |  |  |  |  |  |  |  | 15 | - |