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**Curriculum**

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| --- | --- | --- | --- |
| **Program** | | Master program – **ELECTRIC POWER ENGINEERING** | |
| **Degree awarded** | | **Master of Science in Electric Power Engineering** | |
| **Faculty** | | **Faculty of Technical Engineering** | |
| **Program coordinator/coordinators** | | **Lali Zivzivadze, Associate Professor** | |
| **Length of the program (semester, ECTS)** | | 120 credits  one credit point – 25 hours, 3000 hours in all  - the Program’s compulsory courses – 100 credits  - elective module courses – 20 credits | |
| **Language of the Program** | | | **Georgian** |
| **Program development and renewal date of issue** | | |  |
| **Program prerequisites** | | | |
| Document confirming the first level of higher education. For citizens of Georgia – certificate of confirmation of passing the unified national Master’s exams and the University exam or the equivalent document for foreign citizens, in the case of the appropriate inter-state agreement. | | | |
| **Aim of the Program** | | | |
| **The Program is aimed to train** specialist for Power Industry sector with the second level of higher education in Electrical Engineering in accordance with market demands, who with acquired competences, meets market demands and is ready for projecting, designing, technological, organizational-legal and research activities. | | | |
| **Learning outcomes (the map of competences - see attached document 2)** | | | |
| **Knowledge and understanding** | **Extensive knowledge of the field, which implies a critical analysis of the theories and principles and understanding of some complex issues of the field.**  A graduate is expected: to have sufficient knowledge in the field of electric power engineering for solving non-standard problems; to have knowledge about performing typical for the field theoretical and experimental studies, data processing and generalizing obtained results; to be able to develop new technological processes and equipment in compliance with previously identified requirements; to be knowledgeable about methods of modeling physical processes and understand the need for their utilization for a specific case; to be knowledgeable about methods for developing electric power systems, equipment and devices and to be able carry out analysis on the basis of this knowledge. | | |
| **Applying knowledge** | After the completion of the program, a graduate is expected: to use typical for the field and some specific methods, in order to solve problems, and to implement the research or practical projects in accordance with previously determined guidelines; to be able to develop small and medium projects typical of the field of electric power engineering; to be able to identify typical for the field problems, formulate and resolve production and design problems on the basis of practical application of theoretical knowledge and an integrated approach; to have skill of searching, analysis and synthesis of information, drawing conclusions and preparing reports; to be able to develop training and guidance materials, as well as suggestions of measures for implementation of the created projects; to organize and carry out research activities relating to the development of the programs and projects; to carry out expertise of technical documentation; to be knowledgeable about computer-based methods of data processing and be able to use them. | | |
| **Making judgement** | After the completion of the program, a graduate is expected: to be able to calculate technical and technological systems, including by using the special programs and to determine the best option; to be able to carry out the drawing and designing expertise and to use knowledge and problem solving skill in a new or unfamiliar environment in the discipline-related or multidisciplinary context. | | |
| **Communication skills** | After the completion of the program, a graduate is expected: to communicate in native and foreigh languages; to have managerial skills; to provide the organization and coordination of the work of a team; to be able to manage and implement projects, and to plan and control activities related to this project; to be able to analyze information about work accomplished, draw conclusions and prepare reports in written and oral forms; to provide the organization of vocational education of others and stimulate production initiative of a team. | | |
| **Learning skills** | After the completion of the program, a graduate is expected: to assess critically his-her own professional knowledge and to have skills for optimal planning his/her own process of studying throughout life; to be able to assess the needs for professional knowledge of a team and give them advice for improving this knowledge and provide consultations on professional issues. | | |
| **Values** | After the completion of the program, a graduate is expected: to participate in a process of building values and seek to entrench them; to have active public position; to strive for promotion of energy efficiency and energy conservation; to promote the use of renewable energy sources. | | |
| **Teaching methods** | | | |
| Discussion/debates, collaborative work, teamwork, problem-based learning, heuristic approach, case studies, brainstorming, role and case plays, demonstrative method, induction and deduction methods, method of analysis and synthesis, verbal or oral method, writing method, laboratory method, practical methods, explanatory method, action-oriented teaching. | | | |
| **Structure of the Program** | | | |
| **See the Study Schedule as an attached document 1** | | | |
| **Assessment System** | | | |
| The assessment schemes for each particular course are given in syllabuses presented in annexes to this Program.  The assessment of the academic performance of student during the semester is made on the basis of adding up the mid-term and final examination assessments. Maximum course assessment score is 100 points. Student has the right to take the final exam, if his/her minimum assessment score at mid-term examination is 18 points.  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 minimum assessment score of student at Final Examination is 15 points.  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.  The students grading scheme includes,  **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.  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 she/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. 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.  Student’s performance assessment criteria:   1. Assessment of a level of student’s performance in each component of the Program must include mid-term and final assessments. 2. From total assessment score (100 points), it is necessary to determine the share of each form and component of the assessment in the final assessment (may be indicated as a percentage). 3. It is unacceptable to award credit using only one assessment form (mid-term or final assessment). Student is awarded credit in case of a positive assessment as is provided for in article 4, paragraph 9. 4. Each assessment form includes the assessment components, which involve the assessment methods, but the assessment methods are measured by the assessment criteria. 5. The assessment component, method and criterion must be adequate to the assessment of learning outcomes to be reached and envisaged by the educational program. 6. Master’s thesis, project/paper or other research project or paper are to be assessed during the same or subsequent semester, whn student completed his/her work on it. Master’s thesis, research project/paper must be assessed on a one-off basis in the form of final assessment. The relevant method/methods and criteria must be used in the assessment. | | | |
| **Employment opportunities** | | | |
| * Power plants and systems; * Urban and industrial enterprises electric networks and systems; * Utility distribution companies; * Energy equipment diagnostic and certification centers; * Energy and Water Supply National Regulatory Commission; * Design and educational-research institutions. | | | |
| **Supportive resources** | | | |
| See Annex 3 | | | |

Attachment 1

**Akaki Tsereteli State University**

**Faculty of Technical Engineering**

**Master Program**

**ELECTRIC POWER ENGINEERING**

**Study Schedule 2017-2019**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| № | Course title | Hours per week | Number of credits | Number of hours | | | | Lect./practic./group/lab | Semester | | | | | | | |  | |
| Total | Contact hours | | Independent | I | II | III | IV | V | VI | VII | VIII | | Precondition | |
| Class hours | Mid-term and final exams |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | | 18 | |
| 1 | Training component | | | | | | | | | | | | | | | | | |
|  | Foreign language | | | | | | | | | | | | | | | | | |
| 1.1 | Foreign Language 1 |  | 5 | 125 | 45 | 2 | 78 | 0.45.0. | 5 |  |  |  |  |  |  |  | |  | |
| 1.2 | Foreign Language 2 |  | 5 | 125 | 45 | 2 | 78 | 0.45.0. |  | 5 |  |  |  |  |  |  | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Technical courses | | | | | | | | | | | | | | | | | |
| 1.3 | Experimental design and analysis |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 | 5 |  |  |  |  |  |  |  | |  | |
| 1.4 | Mathematical methods in electric power engineering |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 | 5 |  |  |  |  |  |  |  | |  | |
| 1.5 | Electromagnetic transient processes in the electrical systems |  | 5 | 125 | 45 | 2 | 78 | 15.15.15 |  | 5 |  |  |  |  |  |  | |  | |
| 1.6 | Electromechanical transient processes and electrical system stability |  | 5 | 125 | 45 | 2 | 78 | 15.15.15 |  |  | 5 |  |  |  |  |  | |  | |
| 1.7 | Energy efficiency and energy saving technologies |  | 5 | 125 | 45 | 2 | 78 | 30.15.0 | 5 |  |  |  |  |  |  |  | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Economic, managerial and marketing courses (25 credits) | | | | | | | | | | | | | | | | | |
| 1.8 | Management of energy companies |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.9 | Energy and environmental protection |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 | 5 |  |  |  |  |  |  |  | |  | |
| 1.10 | Electric power markets and their management |  | 5 | 125 | 45 | 2 | 78 | 30.15.0 |  | 5 |  |  |  |  |  |  | |  | |
| 1.11 | Energy audit |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 | 5 |  |  |  |  |  |  |  | |  | |
| 1.12 | Foundations and systems of electric power metering |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  | 5 |  |  |  |  |  |  | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Master’s thesis, research work, practice (45 credits) | | | | | | | | | | | | | | | | | |
| 1.13 | Master’s thesis |  | 30 | 750 |  |  |  |  |  |  |  | 30 |  |  |  |  | |  | |
| 1.14 | Educational practice |  | 5 | 125 | 45 | 2 | 78 | 0.45.0 |  | 5 |  |  |  |  |  |  | |  | |
| 1.15 | Research practice |  | 5 | 125 | 45 | 2 | 78 | 0.45.0 |  |  | 5 |  |  |  |  |  | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | **Total** |  | **100** |  |  |  |  |  | **100** | | | | | | | | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | **Program’sd elective modules (20 credits)**  Module 1  **Power Plants (Electrical Annex), Networks, Systems and their Management** | | | | | | | | | | | | | | | | | | |
| 1.1.1 | Electrical systems operating regimes and their optimization |  | 5 | 125 | 45 | 2 | 78 | 15.15.15 |  | 5 |  |  |  |  |  |  | |  | |
| 1.1.2 | Foundations of electric power long-distance transmission |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.1.3 | Foundations of design of the electrical systems |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.1.4 | Operative management of the electric power systems |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
|  | **Total** |  | **20** |  |  |  |  |  | **20** | | | | | | | | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Elective module 2  **Alternative Energy Engineering** | | | | | | | | | | | | | | | | | | |
| 1.2.1 | Energy storage units |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.2.2 | Wind power installations, equipment, technological schemes and design foundations |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  | 5 |  |  |  |  |  |  | |  | |
| 1.2.3 | Solar power installations, equipment, technological schemes and design foundations |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.2.4 | Geothermal power installations, equipment, technological schemes and design foundations |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
|  | **Total** |  | **20** |  |  |  |  |  | **20** | | | | | | | | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Elective module 3  **Hydropower Industry** | | | | | | | | | | | | | | | | | | |
| 1.3.1 | Micro- and small hydropower plants, and their design foundations |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  | **5** |  |  |  |  |  |  | |  | |
| 1.3.2 | Hydro-electric power installations |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | **5** |  |  |  |  |  | |  | |
| 1.3.3 | Foundations of Fluid Mechanics |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | **5** |  |  |  |  |  | |  | |
| 1.3.4 | Operating regimes, operation and management of HPPs |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | **5** |  |  |  |  |  | |  | |
|  | **Total** |  | **20** |  |  |  |  |  | **20** | | | | | | | | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Elective module 4  **Electromechanics** | | | | | | | | | | | | | | | | | | |
| 1.4.1 | Foundations of electromechanics and electrodynamics |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  | 5 |  |  |  |  |  |  | |  | |
| 1.4.2 | Nonstationary behavior of electrical machinery and apparatus |  | 5 | 125 | 45 | 2 | 78 | 30.0.15 |  |  | 5 |  |  |  |  |  | |  | |
| 1.4.3 | Technological bases of the designs of electrical machinery and apparatus |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.4.4 | The amount and standards of testing of electrical machinery and apparatus |  | 5 | 125 | 45 | 2 | 78 | 30.0.15 |  |  | 5 |  |  |  |  |  | |  | |
|  | **Total** |  | **20** |  |  |  |  |  | **20** | | | | | | | | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
|  | Elective module 5  **Electric Power Transmission by Direct Current** | | | | | | | | | | | | | | | | | | |
| 1.5.1 | Powered electronic switches |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  | 5 |  |  |  |  |  |  | |  | |
| 1.5.2 | High-voltage commutation and protection devices |  | 5 | 125 | 45 | 2 | 78 | 15.30.0 |  |  | 5 |  |  |  |  |  | |  | |
| 1.5.3 | Direct current transfer and connections |  | 10 | 250 | 90 | 2 | 158 | 30.60.0 |  |  | 10 |  |  |  |  |  | |  | |
|  | **Total** |  | **20** |  |  |  |  |  | **20** | | | | | | | | |  | |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | |  | |
| **Total** | |  | **120** |  |  |  |  |  | **120** | | | | | | | |  | |