



საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

Approved by
Academic Council of GTU
On 20 February 2015 By
Decree № 1438

Modyfy by
Academic Council of
GTU On 19 May 2016 By
Decree №2005

Doctoral Education Program

Title of the program

Water Engineering

წყლის ინჟინერია

Faculty

Civil Engineering

სამშენებლო

Program Supervisor / Supervisors

Professor Alexander Davitashvili

Awarded qualification

Doctor of Environmental Engineering and Safety

Will be awarded in the case of passing not less than 180 credits of an educational program.

Credits for the Course

180 Credits

Language of instruction

English

The Objective(s) of the Course

Prepare a modern competitive water resources engineer, activity-oriented in design, research, practice and exploitation; who will be able provide design and operational works of water bodies maintaining construction norms and rules, based on the knowledge of most recent developments and innovative methods. Will be able independently provide planning, implementation and supervision of Innovative Research, clearly and soundly demonstrate a new knowledge of Water Engineering in conjunction

with existent knowledge and involve in thematic debates with the international scientific community. Will be motivated to a worthy contribution to the socio-economic development from the professional point of view. Will be able provide the critical analysis, synthesis and evaluation of new, complex and controversial ideas, preplanning and development of new methodologies.

Program Description

Program was developed according ECTS system, 1 credit is equal to 27 hours, which is meant as a contact, as well as independent work hours. The distribution of credits represented in the curriculum. The distribution of credits represented in the curriculum. The continuation of program is 3 years (6 semesters) and covers 180 credits (ECTS). Educational component - 60 credits and research component - 120 credits.

The first-year learning process (two semesters, 42 weeks) are scheduled as follows: in first semester four educational component (5 credits each) and Thesis Research Project / Prospectus - 1 (10 credits). Before ending first semester in seventh and fourteenth week Doctorate submit in written form to supervisor prospectus results at this stage of the work. The supervisor assesses work maximum of 30 points based on the 3 components (1. Definition and justification novelty of the research theme - a maximum of 5 points; 2. Definition and explanation of the relevance of the research theme - a maximum of 5 points; 3. The ability of presentation of the research theme - a maximum of 5 points). In second semester two educational component (5 credits each) and Thesis Research Project / Prospectus - 2 (20 credits). Before ending second semester in seventh and fourteenth week Doctorate submit in written form to supervisor prospectus results at this stage of the work. The supervisor assesses work maximum of 30 points based on the 3 components

The logical justification of scientific values of selected theme - a maximum of 5 points; 2. Practical values for the selected theme - a maximum of 5 points; 3. The ability of presentation of the theme - a maximum of 5 points). The final assessment of second prospectus is provide by supervisor in written form according 4 components (1. Usage of research methods - a maximum of 5 points; 2. The presumable structure of the thesis - a maximum of 5 points; 3. Bibliography (fountainhead, scientific literature) - A maximum of 5 points; 4. Ability to represent the community - a maximum of 5 points). The work assessed maximum of 40 points. The duration of education in each semester is 15 weeks, 2 weeks intermediate examinations. It means that studying and 2 intermediate examination provided in 17 weeks (I-XVII weeks). During XVIII - XXI weeks provided Main and supplementary examinations. Prospectus prepared by the Doctorate is assessed by a supervisor in a form of written exam maximum of 100 points, two mid-assessment (30 + 30) and final examination (40) point total.

The second-year learning process dedicated to preparation of two thematic seminar. The amount of credits of each thematic seminar is 15. To qualify for the seminar in the 4th and 7th weeks Doctorate, with a view to mid-assessment, present seminar work to supervisor, who assesses the seminar content according 4 components (1. Access to necessary Information / maximum rate - 5 points; 2. Identify the problem / maximum rate - 5 points, 3. The efficiency of usage of information / maximum rate - 5 points; 4. The system of used research methods / maximum rate - 5 points). The work assessed maximum of 30 points. Seminar work with mid-assessment of supervisor will be submitted to the Dissertation Council (no later than 15 weeks of studying). Seminar work, its public presentation and take part in discussion assessed by each member of Dissertation Council maximum of 40 points according 4 components (1. Critically assessment of information and its sources, the maximum rate - 5 points; 2. The conclusions and results, the maximum rate - 5 points, 3. The quality of providing research, the maximum rate - 5 points, 4. The ability presentation of theme, the maximum rate - 5 points). Each Doctorate thematic seminar is rated for a maximum of 100 points, two intermediate (30

+ 30) and final (40) points total.

In the same year doctorate prepare two theoretical/experimental researches, Colloquium-1 (15 credits) and Colloquium-2 (15 credits). The two mid-term assessment of research is provided by the supervisor of a maximum 30 points based on 5 components (1. The research methods and direction are in accordance with the assigned task at this stage - a maximum of 5 points; 2. The research quality at this stage - up to 5 points; 3 To make conclusion based on the research at this stage - a maximum of 5 points; 4. Determination the next direction of research - a maximum of 5 points; 5. The ability to represent theme - a maximum of 5 points). Total 60 (30 + 30) points. The final assessment is provided by Dissertation Council of Faculty of a maximum 40 points based on 5 criteria (1. The research methods and direction are in accordance with the assigned task at this stage - a maximum of 5 points; 2. The research quality at this stage - up to 5 points; 3 To make conclusion based on the research at this stage - a maximum of 5 points; 4. Determination the next direction of research - a maximum of 5 points; 5. The ability to represent theme - a maximum of 5 points).

The third-year learning process dedicated to theoretical/experimental research, Colloquium-3 (30 credits). The two mid-term assessment of research is provided by the supervisor of a maximum 30 points based on 5 components (1. The research methods and direction are in accordance with the assigned task at this stage - a maximum of 5 points; 2. The research quality at this stage - up to 5 points; 3 To make conclusion based on the research at this stage - a maximum of 5 points; 4. Determination the next direction of research - a maximum of 5 points; 5. The ability to represent theme - a maximum of 5 points). Total 60 (30 + 30) points. The final assessment is provided by Dissertation Council of Faculty of a maximum 40 points based on 5 criteria (1. The research methods and direction are in accordance with the assigned task at this stage - a maximum of 5 points; 2. The research quality at this stage - up to 5 points; 3 To make conclusion based on the research at this stage - a maximum of 5 points; 4. Determination the next direction of research - a maximum of 5 points; 5. The ability to represent theme - a maximum of 5 points).

Assessment of doctorate public presentation is provided by calculation of average points determined by each member of the Council. The thesis is not considered to be fulfilled if the majority of members of the Council estimates the thesis less than 20 points. In case of equal number of votes is decisive vote of the chairman.

The educational and research components of Doctoral program and their assessment see the following:

http://gtu.ge/Study-Dep/Files/Pdf/doq_sefaseb_wesi_SD.pdf; <http://gtu.ge/Learning/doctorantura.php>

Programme Prerequisites

Master's degree or equivalent academic degree diploma. Be taken into account: The existence of scientific publications; Participation in scientific conferences; Academic / research materials and other related documents (certificates, diplomas, patents, etc.).

The accordance of Doctoral candidates to PhD program establishes the faculty provisional commission according to the GTU regulations about Dissertation council and Doctorate (Article 5, paragraph. 6, 7, 8).

http://gtu.ge/Study-Dep/Files/Pdf/doqtorantura_debuleb_2014.10.14_SD.pdf

Learning Outcome/Competencies (General and Applied)

Knowledge and understanding

- Have knowledge based on the latest achievements in the field of Environmental engineering and safety. Knows the modern Environmental technologies and their applications;
- Knows utilisation of innovative methods of rational usage and protection of water resources;
- Knows modern alternative decision making approaches according to consumer's requirements;

- Knows innovative methods for implementation of the engineering project; independent develop project management plan;
- Knows how to create reliable models for water distribution, groundwater and watersheds using of modern engineering program RIBASIM;
- Knows the relationships of cultural, economic, social, political and organisational factors with technical factors and their impact on project outcomes and instability of policies;
- Have the knowledge and understanding of the theory of similarity and dimensions; histogram construction modern methods of Database tables;
- Knows the revised methodology for providing and processing of experiments;
- Has ability of understanding renewable bounds of knowledge by renovate analysis and partial reevaluation of modern teaching and learning methods.

Applying knowledge

- Can independently provide innovative research policy and strategy for planning implementation and supervision Environmental engineering and safety projects;
- Can to develop new research and analytical methods and approaches, which are oriented on the creation of new knowledge and are reflected in international refereed publications;
- Can be used mechanical-mathematical methods research, providing experiments, and process the results;
- Can independently plan, conduct, provide prevention and treatment and supervise-controlling of water supply works; Develop modern research and analytical methods and approaches;
- Can build models using RIBASIM and through them regulate river basin;
- Can independently develop, implement and manage of the engineering projects;
- Able to use received knowledge in teaching and guidance of student's scientific-research works using analytical methods and approaches.

Making judgments

- Can provide a new, complex and controversial ideas and approaches to critical analysis, synthesis and evaluation in the rapidly developing field of Environmental engineering and safety, supports the elaboration / development of a new methodology.
- Can make a critical analysis of the information obtained as a result of scientific-research, collation and synthesis of achieved results, forming reasoned conclusions;
- Can provide critical analysis of the new and complex engineering data and approaches and indecently make right decisions for solving the problem.

Communication skills

- Can to present own conclusions and arguments of water engineering within academic and professional society;
- Can to engage in thematic debates with international scientific community;
- Can presented scientific potential and research results reasoned and clearly;
- Can make a target public speech within different types of to the audience, including presentation and interpersonal communications with international scientific community, take part in thematic debates;
- Can represent technical report of own opinions reasoned and clearly during technical design process;
- Will be able clearly present the project gradual progress reports and project proposals within wide scientific-technical audience;

Learning skills

- Has readiness based on the most recent achievements to develop new ideas or processes of

learning and activities, including research process in the rapidly developing field of Environmental engineering and safety;

- During learning and research processes can develop/generate innovative ideas based on the most recent scientific achievements.

Values

- Has a commitment to professional conduct and ethical responsibility of the engineer;
- Research of the new ways for inculcation of science, as our new social and scientific values and establish the innovative methods for this value.

Forms and Methods of achieving of the learning outcomes

- Lecture Practical Classes Seminar Laboratory classes Scientific-Thematic Seminar
 Independent Work Research component Consultation Design of Doctoral Thesis
 Doctoral Thesis

Teaching methods. during studying process the following methods are used to study the specifics of the course, which is given in the syllabi of the course;

1. Discussion/debates. This is the most widely spread method of interactive teaching. A discussion process greatly increases the quality of students' involvement and their activity. A discussion may turn into an argument and this process is not merely confined to the questions posed by the teacher. It develops students' skills of reasoning and substantiating their own ideas.

2. Case study – the teacher discusses concrete cases together with the students and they study the issue thoroughly. E.g., in the sphere of engineering safety it can be a discussion of a concrete accident or catastrophe, or in political science it can be a study of a concrete, e.g., Karabakh problem (Armenian-Azeri conflict).

3. Demonstration method implies presenting information with the help of visual aids. It is quite effective in reaching the required result. It is frequently advisable to present the material simultaneously through audio and visual means. The material can be presented both by a teacher and a student. This method helps us to make different steps of perceiving the teaching material more obvious, specify what steps the students are supposed to take independently; at the same time this strategy visually shows the essence of an issue/problem. Demonstration can be very simple.

4. Verbal or oral method comprises a lecture, narration, conversation, etc. During the process the teacher conveys, explains the material verbally, and students perceive and learn it by comprehending and memorizing.

5. Written method implies the following forms of activity: copying, taking notes, composing theses, writing essays, etc.

6. Practical methods unite all the teaching forms that stimulate developing practical skills in students. In this case a student independently performs different kinds of activity on the basis of the knowledge acquired.

7. Explanatory method is based on discussing a given issue. In the process of explaining the material the teacher brings concrete examples the detailed analysis of which is made in the framework of the given topic.

8. Activity-oriented teaching implies teachers' and students' active involvement in the teaching process, when practical interpretation of the theoretical material takes place.

9. Collaborative work; using this method implies dividing students into separate groups and giving each group its own task. The group members work at their issues individually and at the same time share their opinions with the rest of the group. According to the problem raised, it is possible to shift the functions among the group members in this process. This strategy ensures the students' maximum

involvement in the learning process.

Student's Knowledge Assessment

Assessment is based on a 100 point grading scale.

Positive assessment is:

- (A) - excellent - 91% and more of the maximum grade;
- (B) - very good - 81-90% of the maximum grade;
- (C) - good - 71-80% of the maximum grade;
- (D) - satisfactory - 61-70% of the maximum grade;
- (E) - enough - 51-60% of the maximum grade;

Negative assessment is:

- (FX) - not passed - 41-50% of the maximum grades. It means that a student needs more individual work, and is given one more possibility to pass the exam;
- (F) - failed - 40% and less of the maximum grade. It means that work performed by a student was not enough and the subject should be learnt from the beginning;

Doctoral thesis is to assess the 100-point system:

- a) Excellent (*summa cum laude*) – Excellent work
- b) Very good (*magna cum laude*) - result that exceeds the requirements in every way;
- c) Good (*cum laude*) - result that exceeds the requirements;
- d) Average (*bene*) - result that meets the requirements in every way;
- e) Satisfactory (*rite*) - a result that, despite the shortcomings, still meets the requirements;
- f) Unsatisfactory (*insufficient*) - a result that does not meet the requirements due to significant deficiencies;
- g) Completely unsatisfactory (*sub omni canone*) - a result that does not meet the requirements completely.

The corresponding forms and methods of assessment of students knowledge are present in syllabuses and the University web-page in the document, " The evaluation procedure of educational and research components of Doctoral program ":

<http://gtu.ge/quality/new/Evaluating%20students.pdf>;

<http://gtu.ge/Learning/doctorantura.php>

Sphere of Employment

The graduates of the Water Engineering Doctoral program can work in government institutions, consulting firms and agencies, research and educational institutions, whose activities are related to innovation, creation of new knowledge and analytical approaches in the field of water and environmental engineering. Also, in international and local environmental organisations, relevant ministries and agencies; supervision and architecture institutions of Mayor's Office, municipalities; Cities utility services; in such companies, as „Georgian Water and Power Company” and “Georgian United Water Supply Company”. His official duty and its scope can be defined as a highly qualified scientific researcher or from manager at different levels to a high-ranking executive.

Required human and material resources

The program provides the appropriate human and material resources.

Doctoral program provided at the Faculty of Civil Engineering of Georgian Technical University maintained by the following material and technical resources:

1. Lectures and studying classes;
2. Computer Center with the appropriate software;
3. Virtual laboratories;
4. The educational laboratory of pumps;
5. Building internal Plumbing Equipment Laboratory;
6. Hydraulics Laboratory;
7. Educational and scientific lab of the Civil Engineering Faculty;
8. The Faculty library.

In Tsoetne Mirtsxulava Institute of Water Management:

1. The laboratory of studying of hydraulic structures;
2. Pumping station;
3. Modern irrigation and drainage research facility;
4. hydrogeological and engineering geological laboratory;
5. The reservoir for 10 pieces determining the flow profile of of different shapes;
6. Laboratory for studies of soil and water chemical;
7. The laboratory for study of ground-soils;
8. Hydraulic device for flood modeling, 2 pieces;
9. River-bed processes Modeling Laboratory;
10. The laser device used to study erosion processes;
11. The object of the study bio-engineering events in the open nursery garden;
12. Sea coasts abrasive (erosive) processes and large-scale modeling smallscale machine.

Program is provided by following academic staff (CV- s are attached):

1. Levan Klimiashvili professor, Doctor of Technical Science (water supply and sewerage);
2. Irakli Kruashvili, professor, Doctor of Technical Science (water management, land reclamation);
3. Irina Khomeriki, professor, Doctor of Technical Science;
4. Irma Inashvili, professor, PhD (water management, land reclamation);
5. Alexander Davitashvili, professor, PhD (environmental protection, wastewater treatment).

For more information see the attached documentation.

Educational Program Scheme

№	Course Code	Educational and Research Components	I Year		II Year		III Year		Total Credits
			I Semester	II Semester	III Semester	IV Semester	V Semester	VI Semester	
			Educational Component	20	10	15	15		
1.	SCT0008EA1	Scientific Communication Techniques and the Modern Methods of Study	5						5
2	MSRWE01EA1	Methods of Scientific Research and Their Use in Water Engineering	5						5
3	WSENG01EA1	Water Systems Engineering	5						5
4	MGTWT01EA1	Modern “Green” Technologies of Water Treatment	5						5
5	ENVSD01EA1	Environment and Sustainable Development		5					5
6	WRMOD01EA1	Water Resources Modelling		5					5
7	-	First Thematic Seminar			15				15
8	-	Second Thematic Seminar				15			15
		Research Components	10	20	15	15	30	30	120
1	-	Thesis Research Project / Prospectus - 1	10						10
2.	-	Thesis Research Project / Prospectus - 2		20					20
3.	-	Theoretical / Experimental research / Colloquium - 1			15				15
4.	-	Theoretical / Experimental research / Colloquium - 2				15			15
5.	-	Theoretical / Experimental research / Colloquium - 3					30		30
6.	-	Thesis Completion, Presentation						30	30
ECTS Credits			Per semester		30	30	30	30	180
			Per year		60	60	60		180

Map of study results

Nº	Course Code	Subject	Knowledge and understanding	Applying knowledge	Making judgments	Communication skills	Learning skills	Values
1	SCT0008EA1	Scientific Communication Techniques and the Modern Methods of Study	X	X		X	X	
2	MSRWE01EA1	Methods of Scientific Research and There Use in Water Engineering	X	X		X	X	
3	WSENG01EA1	Water Systems Engineering	X	X	X		X	
3	MGTWT01EA1	Modern “Green” Technologies of Water Treatment	X	X	X			X
4	ENVSD01EA1	Environment and Sustainable Development	X	X	X			X
5	WRMOD01EA1	Water Resources Modelling	X	X		X	X	
6	-	First Thematic Seminar	X	X	X	X	X	X
7	-	Second Thematic Seminar	X	X	X	X	X	X

Program Curriculum

Nº	Course Code	Subject	Programme Prerequisites	ECTS Credits/Hours	Lecture	Seminar	Practical classes	Midterm/Final examinations	Independent Work
1	SCT0008EA1	Scientific Communication Techniques and the Modern Methods of Study	N/A	5/135	1/15	1/15	-	2/1	87
2	MSRWE01EA1	Methods of Scientific Research and There Use in Water Engineering	N/A	5/135	1/15	-	2/30	2/1	87
3	WSENG01EA1	Water Systems Engineering	N/A	5/135	1/15	-	2/30	2/1	87
4	MGTWT01EA1	Modern “Green” Technologies of Water	N/A	5/135	1/15	2/30	-	2/1	87

№	Course Code	Subject	Programme Prerequisites	ECTS Credits/Hours	Lecture	Seminar	Practical classes	Midterm/Final examinations	Independent Work
		Treatment							
5	ENVSD01EA1	Environment and Sustainable Development	N/A	5/135	1/15	2/30	-	2/1	87
6	WRMOD01EA1	Water Resources Modelling	N/A	5/135	15	-	2/30	2/1	87

Educational Program Supervisor/ Supervisors

A. Davitashvili

Head of Quality Assurance of the
Faculty of Civil Engineering

M. Javakhishvili

The Acting Dean of Faculty
of Civil Engineering

D. Gurgenzidze

Accepted at

The Council of the Faculty
of Civil Engineering
Proceedings № 1, 12.01. 2015

Modify by

The Council of the Faculty
of Civil Engineering ,
Proceedings №6. 18.03 2016

The Head of the Faculty Council

D. Gurgenzidze

Agreed with

Quality Assurance Service of GTU

G. Dzidziguri