საქართველოს ტექნიკური უნივერსიტეტი
GEORGIAN TECHNICAL UNIVERSITY

Approved by

Academic Council of GTU
On 25 June, 2014
By Decree №1181

Master's Education Program

Title of the program

Water Engineering

Faculty

Civil Engineering

Program Supervisor

Associate Professor Irma Inashvili

Awarded qualification

Master of Construction in Specialization Program Water Engineering
Will be awarded in the case of passing not less than 120 credits of an educational program.

Credits

120 credits

Language

English

Program objective

To prepare the water resources engineer which will be modern requirement appropriate, competitive, performance-oriented, focused on the practical and operational activities. Which, will can provide design and implementation of operational activities given into construction norms and rules, will be motivated to be a professional point of view, a worthy contribution to the social - economic development. Will be able to design, construction and exploitation of water resources management systems using modern computer programs and consideration of risk–factors in the regulatory processes. Will be able to natural water classification, monitoring of water quality and assessment them use the modern standards.

Program Prerequisites

The studying rights on a Master's program is entitled person who has at least a bachelor's or equivalent academic degree and has English knowledge in the level B2, that must be approved by appropriate Certificate from Institution with special Accreditation, or tests providing by the University. The person will be enrolled according the results of the Graduate Record Examination (based on the Graduate Record Examinations, and tests in specialty submitted in the English language). Sample tests will be posted up on the website of the Department of Education of GTU at least one month before the start of the examinations - http://gtu.ge/study/index.php. Admission to the Master's program without passing the examination may be established by the Ministry of Education and Science.

Program Description

The 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 is represented in the curriculum. The duration of the program is 2 years (4 semesters) and covers 120 credits (ECTS) Core courses - 75 credits and research component – 45 credits.

The first-year learning process (two semesters 21-21 weeks) is scheduled as follows: two weeks, particularly in VII and XIV week provided midterm examinations i.e., duration of learning and midterm examinations is 17 weeks. During XVIII- and XXI week provided examinations (Main and supplementary examinations).
In the first semester of given year master learns 3 subjects with 5 credits, 1 subject with 7 credits and 1 subject with 8 credits. In second semester master learns 2subjectswith 5 credits, 1 subject with 7 credits and 1 subject with 8 credits and Graduate Research Project/prospectus, which estimated as 5 credits.

The second-year learning process (one semester 21 weeks) is scheduled as follows: two weeks, particularly in VII and XIV week provided midterm examinations i.e., duration of learning and midterm examinations is 17 weeks. During XVIII- and XXI week provided examinations (Main and supplementary examinations). In the third semester Master learns 1 subject with5 credits, 1 subject with 7 credits and 1 subject with 8 credits and Research/experimental component, which estimated as 10 credits.

In the fourth semester Master completes the master's thesis. Master's thesis completion and presentation include 30 credits.

Learning Outcome/Competencies

Knowledge and understanding:
Deep and systematic knowledge of hydrology and water resources management; Knowledge of physical, chemical, and biological characteristics of water typical pollutants; Knowledge and understanding of physiological, bacteriological and biological processes of water and quality requirements; Understanding the relationship between the technical and environmental issues; Knowledge of modern methods of ground-water research; Knowledge of technical skills of project management and the main design principles; Knowledge of engineering design and implementation stages of planning; Understanding the basic principles of economic activity and the conditions for their realization; Understanding the complex issues of monitoring; Knowledge of modern engineering computer programs“RIBASIM” and“WEAP”. Understanding the individual solution of the problems in the water engineering.

Applying knowledge:
Independently planning, construction and exploitation of various water systems. The large scale data analysis and statistical processing of data in water engineering; Select the apporpiat eengienring solution and their use in practice; Independently solution of engineering tasks using “RIBASIM”and“WEAP”computer programs.Understanding, analysis and interpretation of hydrological data; Selected mechanical properties of engineering materials (characteristics) Experimental determination; Engineering tasks related to the implementation of engineering design; Specific engineering-practical tasks of logical schemes.

Making judgments:
Has the ability of the abstract thinking, analysis, synthesis, identification of problems, questions, analyzing and establishing a reasonable inference ability of computer programs using engineering data collection, analysis and reasoned conclusions; Understanding the scope of work, error detection, error analysis of the relevant technical literature in support of these conclusions; Calculation and analysis of engineering structures based on reasoned conclusions; Protective measures for natural resources, engineering analysis and evaluation of alternatives; Adequate communication with the particular audience in order to make an appropiat judgment.

Communication skills:
In the process of designing make clear conclusions throught the oral presentation and writing technical reports, and discussion; Submission and presentation of the midterm technical reports to the wide audience; Submission of the oral presentations and written technical reports to the xpertasand non-specialists in an acceptable manner; Obtain, processing and presentation of the information for the experts in laconic way using the modern information and communication techniques;, Provision of the presentations to the target audience and carry ou the interpersonal communication.

Learning skills:
Assessment of the personal learning process in a coherent and versatile way; After the completion of the educational program, development of the professional career, identification the further learning needs. Identification of the needs in personal learning process in the filed of water governance; Finding the Learning means, understanding the learning characteristics of the process based on the strategic planning and management of future learning.

Values:
Professional ethics in accordance with the basic laws of action; Conductn the engineer's professional, ethical responsibility and values to promote the quest. Critical unpredictable situations in professional behavior and ethical norms of engineers; Participation in the formation of values, attitudes toward their quest for respect and promote.

Forms and Methods of achieving the learning outcomes

☒Lecture ☒Seminar(working in the group) ☒Practical classes ☒Laboratoryclasses ☒Field Work/Practice ☒ Course Work/Project ☒Consultation Hours ☒Independent Work ☒Master Thesis

The most widely spread teaching and learning methods. A teacher should choose the proper method according to the concrete aim and problem.

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. **Cooperative teaching** is a teaching strategy in the process of which each member of a group not only has to learn the subject himself, but also to help his fellow-student to learn it better. Each member of the group works at the problem until all of them master the issue.
3. **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.
4. **Problem-based learning (PBL)** is a method which uses a concrete problem as the initial stage both for acquiring new knowledge and integration process.
5. **Heuristic method** is based on the step-by-step solving of a given problem. It is realized by means of independent fixing of the facts in the teaching process and determining the ties among them.
6. **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).
7. **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.
8. **Inductive method** determines such a form of conveying any kind of knowledge when in the process of learning the train of thought is oriented from facts towards generalization, i.e. while presenting the material the process goes from concrete to general.
9. **Deductive method** determines such a form of conveying any kind of knowledge which presents a logical process of discovering new knowledge on the basis of general knowledge, i.e. the process goes from general to concrete.
10. **Analytical method** helps us to divide the whole teaching material into constituent parts. In this way the detailed interpretation of separate issues within the given complex problem is simplified.
11. **Synthetic method** implies forming one issue from several separate ones. This method helps students to develop the ability of seeing the problem as a whole.
12. **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.

13. **Written method** implies the following forms of activity: copying, taking notes, composing theses, writing essays, etc.
14. **Laboratory method** implies the following forms of activity: conducting experiments, showing video materials, etc.
15. **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 e.g. field study, teaching practice, field work, etc.
16. **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.
17. **Activity-oriented teaching** implies teachers' and students' active involvement in the teaching process, when practical interpretation of the theoretical material takes place.
18. **Designing and presenting a project.** While designing a project a student applies the knowledge and skills he has acquired for solving a problem. Teaching by means of designing projects increases students' motivation and responsibility. Working on a project involves the stages of planning, research, practical activity and presenting the results according to the chosen issue. The project is considered to be completed if its results are presented clearly, convincingly, and correctly. It can be carried out individually, in pairs or in groups; also, within the framework of one or several subjects (integration of subjects); on completion the project is presented to a large audience.

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;

Descriptions of the methods, criteria, and scales of student knowledge assessment attached to the educaitonal program.Also, it is uploaded to the university web-site: http://www.gtu.ge/Study-Dep/Forms/Regulations.php

Sphere of Employment

The knowledge acquired by graduates of the program can successfully work in such water supply and wastewater systems companies, industrial and commercial enterprises, civil organizations, government agencies, consulting firms and agencies, energy companies, in corresponding, Ministries and their affiliated agencies; Supervision and Architecture Service of municipality; construction agencies, municipal utility services, water supply agencies, regional, municipal and national sewerage organizations and other organizations and educational organizations.

Possibilities for further continues education

Doctoral educational programs

Reared human and material resources

The program provides the appropriate human and material resources. For more information see the attached documents.

The number of attached syllabi: 15
Educational Program Scheme

№	Learning and Scientific Components		I Year		II Year		Credits
			Semester I	Semester II	Semester III	Semester IV	
	Educational Component:						
1	Educational Courses		30	25	20		75
	Research Component:						
2	Graduate Research Project/prospectus			5			5
3	Research/experimental component				10		10
4	Master Thesis					30	30
ECTS Credits		Per semester	30	30	30	30	120
		Per course	60		60		120

Program in total

№	Course code	Course	Prerequisites	ECTS credits			
				I year		II year	
				Semester			
				I	II	III	IV
1	HOSAG01	Hydrology of Surface and Groundwater	N/A	7			
2	WAREA01	Water Resources Assessment	N/A	5			
3	WAQUA01	Water Quality Assessment	N/A	5			
4	WAREN01	Water Resources Engineering	N/A	8			
		Elective		5			
5	ENVCH01	Environmental Chemistry	N/A				
6	MDWSW01	Management of Design of Water Supply and Wastewater Systems	N/A				
7	WRMON01	Water Resources Monitoring	Water Resources Assessment, Water Quality Assessment		7		
8	ENDSD01	Environment Defense and Sustainable Development	N/A		5		
9	WRESP01	Water Resources Planning	Hydrology of Surface and Groundwater, Water resources Engineering		8		
		Elective			5		
10	SOMCA02	Strategic Operation Management for Competitive Advantage	N/A				
11	QMDM102	Decision Making and Quantitative Analysis for Management	N/A				
12	WSYSM01	Water Systems Modeling	Water Quality Assessment , Water Resources Assessment			8	
13	WRIME01	Integrated Water Resources Management	Water Quality Assessment , Water Resources Assessment, Water Resources Planning			7	

№	Course code	Course	Prerequisites	ECTS credits			
				I year		II year	
				Semester			
				I	II	III	IV
		Elective				5	
14	WASHM01	Watershed Management	N/A				
15	MANEN02	Management in Engineering	N/A				
			Educational Components:	**30**	**25**	**20**	**0**
			Research Components:	**0**	**5**	**10**	**30**
			Credits per year	**60**		**60**	
			Total	**120**			

Map of study results

#	Course code	Course	Knowledge and understanding	Applying Knowledge	Making judgments	Communication skills	Learning skills	Values
1	HOSAG01	Hydrology of Surface and Groundwater	x	x	x	x		
2	WAREA01	Water Resources Assessment	x	x			x	
3	WAQUA01	Water Quality Assessment	x	x		x	x	
4	WAREN01	Water Resources Engineering	x	x		x	x	x
5	WRMON01	Water Resources Monitoring	x	x		x	x	x
6	ENDSD01	Environment Defense and Sustainable Development	x	x		x	x	
7	WRESP01	Water Resources Planning	x	x	x			x
8	WSYSM01	Water Systems Modeling	x	x	x			x
9	WRIME01	Integrated Water Resources Management	x	x	x	x		x
		Elective courses						
10	ENVCH01	Environmental Chemistry	x	x		x		
11	MDWSW01	Management of Design of Water Supply and Wastewater Systems	x	x	x		x	
12	SOMCA02	Strategic Operation Management for Competitive Advantage	x	x		x		x
13	QMDM102	Decision Making and Quantitative Analysis for Management	x	x		x		
14	WASHM01	Watershed Management	x	x	x		x	
15	MANEN02	Management in Engineering	x	x		x		

Program curriculum

№	Code	Course / Hours	ECTS Credits/hours	Lecture	Seminar (working in the group)	Practical classes	Laboratory classes	Practice	Course Work/Project	Consultation Hours	Midterm/Final examinations	Independent Work
1	HOSAG01	Hydrology of Surface and Groundwater	7/189	30		45				15	2/1	96
2	WAREA01	Water Resources Assessment	5/135	15		30				15	2/1	72
3	WAQUA01	Water Quality Assessment	5/135	15	30					15	2/1	72
4	WAREN01	Water Resources Engineering	8/216	30		30		30		15	2/1	108
5	WRMON01	Water Resources Monitoring	7/189	30	45					15	2/1	96
6	ENDSD01	Environment Defense and Sustainable Development	5/135	15	30					15	2/1	72
7	WRESP01	Water Resources Planning	8/216	30			30		30	15	2/1	108
8	WSYSM01	Water Systems Modeling	8/216	30			30		30	15	2/1	108
9	WRIME01	Integrated Water Resources Management	7/189	15		30			30	15	2/1	96
		Elective courses										
10	ENVCH01	Environmental Chemistry	5/135	15		30				15	2/1	72
11	MDWSW01	Management of Design of Water Supply and Wastewater Systems	5/135	15		30				15	2/1	72
12	SOMCA02	Strategic Operation Management for Competitive Advantage	5/135	15	30					15	2/1	72
13	QMDM102	Decision Making and Quantitative Analysis for Management	5/135	15			30			15	2/1	72
14	WASHM01	Watershed Management	5/135	15		30				15	2/1	72
15	MANEN02	Management in Engineering	5/135	15		30				15	2/1	72

Educational Program Supervisor I. Inashvili

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Agreed with
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