



Ministry of Education

Test Blueprint for National Exit Examination to be held in 2015 E.C

Band: one

**Program: Bachelor of Science Degree in Water Resources
Engineering**

Compiled By: Lamiso Shura

1. Introduction

The Ministry of Education of Ethiopia has announced the implementation of exit exam for all undergraduate program students (public and private), beginning with the 2022/2023 academic year, in order to improve the quality of graduates produced by higher learning institutions. The exit exam aimed at checking whether students have acquired the required knowledge, skills and attitudes or not. To implement this, it requires determining competency areas for a specific program, which is already completed. Based on the competency areas prepared, it needs to plan the construction of tests.

Planning of a test is a first and vital step in the construction of an achievement test. An achievement test demands very systematic and careful planning, as a fact that good planning is a symbol of success. Tests are the tools that provide scores that measure level of student learning and study program learning outcomes. In order to achieve the valid and reliable measurement of student learning and program learning outcomes, the development of valid and reliable test is the mandatory. Test should be able to measure student performance in all dimensions of knowledge, skill and attitude. The carefully planned test construction contributes to improve the overall quality of the test in terms of test content validity, difficulty level, discrimination power and test reliability. Test preparation is not an easy task; it requires a careful planning and guideline to make the task simple. Test construction needs the preparation of test blue print. Test blueprint is defined as a complete plan that explains how to develop a test. The term refers to a map or specification of assessment to ensure that all aspects of the curriculum and educational domains are covered by the assessment programs over a specified period of time. It helps curriculum developers/test constructors to match various competencies with the course content and the appropriate modality of assessment.

Generally, test blueprint will help to ensure tests: 1) Appropriately assess the achievement of instructional objectives of the course; 2) Appropriately reflect key course goals, objectives and the material learned or covered during the instruction

period; and 3) Include the appropriate item formats along with the knowledge and skills being assessed.

Keeping this in mind, the team has prepared this test blueprint document in order to help the test developers or content specialists in their process of valid and reliable test construction. The major points considered in the process of preparing this test blue print guideline were the core competencies that have been already identified for the themes of courses, the course contents, course credit hours, and the learning outcomes with their corresponding levels of achievement by learning domains. In line with these, the number of test items that should adequately assess the performance of students in all the content topics will be determined through discussion with the content specialists who construct the blueprint and test for their corresponding study program.

2. Objective/ Significance of Test Blueprint Preparation

Test blueprint preparation is generally opted to assist the preparation of a test that is representative, broadly sampled, and consisting of complete knowledge domain expected of the Ethiopian higher education students on completion of their study program.

The specific objectives of test blueprint are to:

- Facilitate the construction of a representative and balanced test items for the selected courses in accordance with the competencies identified.
- Guide test developers or writers to write or set appropriate test items.

3. Expected profile of the Graduates

The program is aimed at producing graduates that can have adequate knowledge, skills and attitude towards application of Water Resources Engineering. Specifically:

- Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization to the solution of complex Water Resources Engineering problems.
- Identify, formulate, research literature and analyze complex Water Resources Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

- Design solutions for Water Resources Engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health, and safety, cultural, societal and environmental considerations.
- Conduct investigations of complex water resources related problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of water resources related data, and synthesis of information to provide valid conclusions.
- Create, select and apply appropriate techniques, resources, modern Water resources engineering and management software and tools, including prediction and modelling, to complex Water Resources Engineering problems, with an understanding of the limitations.
- Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional Water Resources Engineering practice and solutions to complex Water Resources Engineering problems.
- Understand and evaluate the sustainability and impact of professional Water Resources Engineering work in the solution of complex Water Resources Engineering problems in societal and environmental contexts.
- Apply ethical principles and commit to professional ethics, responsibilities, and norms of Water Resources Engineering practice.
- Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
- Communicate effectively on complex Water Resources Engineering activities with the engineering community and society, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
- Demonstrate knowledge and understanding of Water Resources Engineering management principles and economic decision-making and apply these to one's own work as a member and leader in a team, to manage projects and in multi-disciplinary environments.

- Recognize the need for, and have the preparation and ability to engage in, in dependent and life-long learning in the broadest context of technological change.

4. General objective

The general program objective is to educate professionals and scientists who produce excellent water resource developers and managers, who can conceptualize the complex water related issues and bring solution using the state of art innovations and technologies toward contributing effectively to the development and management of water resources on both local and global scale. The proposed program provides multi-disciplinary and high-quality university education in the field of water resources engineering.

5. Specific objectives

- To acquaint with developing hydrographs, frequency analysis, flood routing, reservoir capacity determination and sedimentation, and statistical analysis of hydrological parameters and generation of random numbers.
- To aware about the groundwater scope, occupancy and it's movements in hydrologic cycle, different types of aquifers and their characteristics, field determination of hydraulic conductivity, hydraulics of wells, steady and unsteady states of flow in confined and unconfined aquifers and about the computation of aquifer parameters like storage coefficient, transmissibility coefficient, and permeability coefficient and conduct experiments on pumping test for drawdown computations.
- To equip students with fundamental knowledge of different properties of fluid, hydrostatics, fluid kinematics, fluid dynamics, boundary layer theory and skilled with analysis of pipe flow, making dimensional analysis and introduce the basics of pump and turbine.
- To develop a mechanistic understanding of steady and unsteady fluid flow in channels including streams and rivers.
- To equip students with the basic principles of design of dams.

- To equip students with the basic principles of design of appurtenant structures of dams.
- To introduce the fundamentals of design of hydropower systems and infrastructure.
- To expertise students with the various types of Irrigation and drainage construction.
- To introduce the planning, design, and operation of water resources systems for multiple societal objectives, with emphasis on technical tools and data available to analysts.
- To give students a broad understanding on planning, designing and construction of urban water supply engineering and sewerage system.

6. Themes and list of courses

S.No.	Course Name	Course Code	Course Cr. Hrs.
Theme 1: Hydrology			(6)
1	Engineering Hydrology	WRE220 2	3
2	Groundwater Engineering	WRE320 4	3
Theme 2: Fundamental of Hydraulics			(6)
1	Hydraulics	WRE220 4	3
2	Open Channel Hydraulics	WRE320 1	3
Theme 3: Hydraulic Structures and Hydropower Development			(9)
1	Hydraulic Structures	WRE320 2	3
2	Hydraulic Structures II	WRE420 1	3
3	Hydropower Engineering	WRE420 3	3
Theme 4: Irrigation and Drainage Engineering			(3)
1	Irrigation and Drainage Engineering	WRE320 5	3
Theme 5: Water Resources Planning and Management			(3)
1	Water Resources Planning & Management	WRE520 1	3
Theme 6: Water Supply Engineering			(3)
1	Water Supply and Sewerage	WRE320	3

S.No.	Course Name	Course Code	Course Cr. Hrs.
		3	

Themes	Name of Courses	Cred it hour	General objective	Specific objectives	Learning outcomes								No. of items	No of items from each course	
					Cognitive						Affective	Psychomotor			
					Rememberi	Understand ing	Application	Analvsis	Evaluation	Creation/ Synthesis					
Hydrology (Share of the theme= 20%)	Engineering Hydrology (Share of the course= 10%)	3	to develop hydrographs, frequency analysis, flood routing, reservoir capacity determination and sedimentation, and statistical analysis of hydrological parameters and generation of random numbers.	▪ to acquire the fundamental knowledge to develop the hydrograph,	2								2	9	
				▪ to determine reservoir capacity and sedimentation,		3							3		
				▪ to interpret data using statistics probability			2						2		
				▪ to analysis flood frequency				2					2		
	Groundwater Engineering (Share of the course= 10%)	3	to understand about ground water occurrence ,movement, well hydraulics ,pumping test and ground water modelling	▪ to understand the roles of groundwater in hydrologic cycle,		3								3	9
				▪ to differentiate types of aquifers with their characteristics			3							3	
▪ to compute well hydraulics by apply groundwater flow equations						3							3		
Sub-total		6													

Fundamentals of Hydraulics (Share of the theme= 18%)	Hydraulics (Share of the course= 9%)	3	to equip students with fundamental knowledge of different properties of fluid, hydrostatics, fluid kinematics, fluid dynamics, boundary layer theory, basics pump and turbine and skilled with analysis of pipe flow, making dimensional analysis.	▪ to understand the physical properties of fluids, fluid pressure distributions in static fluids, type and pattern of flow.		2								2	
				▪ to apply hydrostatic equations to calculate the magnitude and location of hydrostatic forces, and forces of buoyancy.			2							2	
				▪ to analyze mass, momentum, and energy conservation of fluids with in the control volume, flow net, and stability of floating and immersed bodies.				2						2	8
				▪ to understand basics of boundary layer theory, hydraulic machines, and design principle of pipe system, dimensional analysis and model studies.	2									2	
	Open channel Hydraulics (Share of the course= 9%)	3	to develop a mechanistic understanding of steady and unsteady fluid flow in channels, define the concepts of open channel flow, and flow properties in open channel, compute flow in different types of channels and different flow types, Application of Different GVF, and RVF flow methods, Design of Canals	▪ to define concepts of open channel flow	2									2	8
				▪ to identify open channel flow type				2						2	
				▪ to drive and apply basic hydraulic principles in open channel flow				2						2	
				▪ to predict expected varied flow profile in				2						2	

				any types of channel slope													
Sub -total		6															
Hydraulic Structures and Hydropower Development (Share of the theme= 31%)	Hydraulic Structures (Share of the course=10.3 %)	3	to understand basic principles of design of dams, select appropriate type of dam for a given site, design different types of dam, check and appreciate safety of dams.	▪ to know basic design principles	2											2	9
				▪ to apply the basic design principles				2								2	
				▪ to analysis of gravity, buttress, arch and embankment dams					2							2	
				▪ to select appropriate site for dams						3						3	
	Hydraulic Structures II (Share of the course= 10.3%)	3	to understand the basic principles of design of appurtenant structures of dams, need of energy dissipation and their design in dams and design diversion head work and canal structures design.	▪ to understand the basic principles of design of appurtenant structures of dams		3										3	9
				▪ to design dam appurtenant structures such as spillways, energy dissipaters and bottom outlets with the knowledge on dam safety: instrumentation and surveillance.												3	
				▪ to design diversion headwork and canal structures							3					3	
				▪ to select appropriate hydropower site configuration						2						2	
	Hydropower Engineering (Share of the course= 10.3%)	3	to introduce the fundamentals of design of hydropower systems and infrastructure, select appropriate site for hydropower development, understand different types of hydropower development arrangements, assess hydropower potential, design basic layout and elements of a hydropower	▪ to assess the potential of hydropower		3										3	9
				▪ to Plan, design of hydropower scheme components							2					2	
				▪ to analysis of the different hydropower scheme components like water conveyance structures and					2							2	

			plant	hydraulic turbines as a source of energy.													
Sub -total			9														
Irrigation and Drainage Engineering (Share of the theme= 10%)	Irrigation and Drainage Engineerin g (Share of the course= 10%)	3	to equip students with the various types of Irrigation and drainage construction, differentiate methods of irrigation and irrigation system components, concepts of open channel flow and water conveyance are dealt in detail	▪ to know basic principles of irrigation methods		3										3	9
				▪ to plan and design of different types of irrigation and drainage system						3				3			
				▪ to differentiate irrigation methods					3						3		
Sub -total			3														
Water Resources Planning and Managemen t (Share of the theme= 11%)	Water Resources Planning & Manageme nt (Share of the course= 11%)	3	to introduce the planning, design, and operation of water resources systems for multiple societal objectives, with emphasis on technical tools and data available to analysts.	▪ to plan and design, of water resources systems							3					3	10
				▪ operate of water resources systems for multiple societal objectives, with emphasis on technical tools and data available				2							2		
				▪ to analysts available data on water resources					2						2		
				▪ to apply of statistical analysis and mathematical simulation and optimization models					3						3		
Sub -total			3														
Water Supply Engineering (Share of the theme= 9%)	Water Supply and Sewerage (Share of the course= 9%)	3	to understanding on planning, designing and construction of urban water supply engineering and sewerage system	▪ understand on planning ,designing and construction of urban water supply and sewerage system		3										3	8
				▪ to plan, design and construction of urban water supply and sewerage system							2				2		
				▪ to apply the technical criteria and guidance on					3							3	

				the assessment of demand, selection of source, collections, and transmission and distribution systems of water supply and sewerage.													
Sub -total		3															
Total item for program																	88

NB: Percent share for theme, Percent share for, total test item for theme and total items for course are calculated by the following formulas

$$\text{Percent share for Theme } i = \frac{\text{Total Credit hour of the Theme } i}{\text{Total Credit hour of the Program } i} \times 100$$

$$\text{Percent share for Course } i = \frac{\text{Credit hour for Course } i}{\text{Total Credit hour of the Theme } i} \times \text{Percent share for Theme } i$$

$$\text{Total test items for Theme } i = \frac{\text{Total Credit hour for Theme } i}{\text{Total Credit hour for Program } i} \times \text{Total of items for the program}$$

$$\text{Total of items for course } = \frac{\text{Credit hour for Course } i}{\text{Total Credit hour for Theme } i} \times \text{Total number of items for Theme } i$$

7. Conclusion

Exit examination can have a vital role in producing knowledgeable, skillful and attitudinally matured graduates. It contributes to prepare competent graduates as it can serve as a quality check for effectiveness. It also helps in improving academic programs quality and effectiveness. Furthermore, it can create the platform for cooperation among academic programs at different universities to work jointly to improve the programs quality. In view of this, this document is produced to assist the setting of the exit examinations for all programs, which is being delivered by Ministry of Education. To meet the graduation profile, competency and learning outcome, exit exam competency selection and identifying core course was done for 2015 EC graduating students. As a result, preparing test blueprint is necessary to prepare fairly distributed items based on the above criteria.