



Identified Competency Focus Areas and Core Courses for National Exit Examination

**Program: Bachelor of Science
Degree in Civil Engineering**

Identified Competencies

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Courses and Competencies Identified for Exit Exam 2015 (First Draft)

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Examination

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1. Introduction

Civil engineering concerns the study of conception, design, construction and maintenance of large public and private projects. Civil engineers build and maintain bridges, highways, railways, tunnels, airports, dams, water treatment and distribution systems and large buildings, along with many other structures. Environmental considerations, such as water supply, pollution control and preservation of soil quality, are also a part of the course of study. With thorough knowledge of both the principles of construction and the possible environmental consequences of a structure, the civil engineer's expertise is one that is essential to our present civilization and one that will become ever more valuable in the future.

The Civil Engineering undergraduate program is aimed at creating well-qualified Civil Engineers with adequate knowledge in the area of structural, highway, geotechnical, and water resources and who can be actively engaged in the planning, development, and management of Civil Engineering projects. Currently, 33 public higher institutions host Civil Engineering as undergraduate programs, and thousands of new graduates join the construction industry every year. It has been reported that most of these graduates lack the required competency by the stockholders who hire them. One of the recommended strategies is the implementation of a university exit examination for prospective graduates to tackle this problem. University Exit Exam is a standardized comprehensive curriculum-based test that is designed to assess if students have achieved the minimum competence that was stipulated in the graduates' profile. The implementation of exit examinations is related to the improvement of the quality of higher education. The feedback from the results of the exit examination is expected to contribute to institutional improvement. This draft document is aimed to present the major focus areas which should be included in the preparation of the Exit Exam for Civil Engineering graduates.

1.1. Objectives of the Exit Examination

The national public administration exit exam shall have the following objectives

- To produce skilled and competent manpower to national and international market
- Assessing students' educational achievement in major areas of Civil Engineering.
- Ensuring whether the graduate profile of Civil Engineering curriculum have achieved at least common standards of knowledge and practical skills.
- Facilitating the efforts of students to revise the core learning outcomes of the courses covered by the exit examination.

- Ensuring all graduates from HEIs satisfy the requirements of the labor market and employability through the national wide implementation of competency-based exit exam

1.2. Significance of the Document

It is important to set competency areas of the subject matter (program) in order to measure the how much graduates are acquired with skills, knowledge and attitudes. The following shows us the significance or setting competencies and identifying core courses of the program;

- To set competencies that helps to assess the basic skills, knowledge and attitude of graduating students.
- To systematically identify the core courses which will be included the exit exam.

2. Expected Profiles of Graduates'

A graduate Civil Engineer is expected to have:

- An ability to apply knowledge of mathematics and science in a specialized area related to Civil Engineering.
- An ability to critically analyze and interpret data in major Civil Engineering areas.
- An ability to analyze and design systems, components, or processes to meet desired needs within realistic constraints such as technical, economic, environmental, social, political, ethical, health and safety, constructability, and sustainability, in major Civil Engineering areas.
- An ability to identify, formulates, and solves Civil Engineering problems in major Civil Engineering areas.
- To conduct experiments, and basic and applied research concerning construction industries to solve various technical, organizational, and social problems.
- An ability to use the techniques, skills, modern engineering tools, and software necessary in major Civil Engineering areas.
- An understanding of professional practice issues such as project management, contract administration, and interactions between the development, design, and construction professions.
- An ability to function in multidisciplinary teams.
- An ability to communicate effectively, orally and in writing.
- An understanding of the professional and ethical responsibilities of Civil Engineers.

3. Learning Outcomes and Competencies

3.1. Learning outcomes

The main and program specific learning outcomes of the BSc program in civil engineering be categorized in to five main thematic areas.

3.1.1. Construction Materials, Building Construction, and Construction Management

- Get basic knowledge of construction materials for Civil Engineering projects.
- Select suitable construction materials for the perspective Civil Engineering project.
- Develop an engineering solution for problems related to construction materials
- Identify different elements of a building
- Understand different building construction techniques & technologies
- Understand and interpret basic building working drawings
- Apply cost-efficient construction principles for building structures and systems to design efficient facilities and optimize their use.
- Understand and apply basic construction procurement and contract management processes.
- Understands basic guidelines and application of contract formulation and administration; and planning and management techniques/tools of construction projects
- Apply major principles of the bidding process, specification writing, quantity surveying, project cost estimation, and construction supervision.
- Schedule construction projects with different scheduling techniques and computer applications.
- Perform economic analysis and evaluation of Civil Engineering projects.
- Apply the principles of safety and health in construction project management and take safety and health measures in construction projects.

3.1.2. Structural Analysis and Design

- Get basic knowledge of the properties and strengths of major construction materials.
- Carry out basic and advanced structural frame analysis with various loading conditions using different methods of structural analysis.
- Comprehends structural mechanics of different civil structures and applies the knowledge in the design of the structures

- Analyze and dimension different structural members using Ethiopian and other standards.
- Ability to apply basic design procedures to design different structural members in a manner that ensures the safety and utility of the structure.
- Solve dimensioning and design problems
- Analyze and design complex structural elements

3.1.3. Geotechnical Engineering

- Understand the behavior of soil/rock.
- Evaluate engineering properties of soil; determine the bearing capacity, lateral earth pressure, and stability of slopes of soil.
- Analyze and design different types of shallow and deep foundations using a different technique.
- Understand & interpret the behavior of different types of soils and be able to design foundations for structures which is the plan to be constructed on these soils.

3.1.4. Road and Transport Engineering

- Understand transportation systems and demonstrate the ability to plan, analyze, and design the basic elements of an integrated surface transportation system for safe and efficient movement.
- Collect, Analyze and interpret traffic flow data.
- Acquainted with the principles of geometric and pavement analysis and design.
- Acquire basic knowledge and practical perspective of highway materials, construction practice, and quality control.
- Evaluate the condition of an existing highway system.
- Identify and solve different geometric and pavement design and material problems.

3.1.5. Hydraulic Engineering

- Comprehends fundamental concepts of fluid mechanics and can understand the basic laws of physical science which govern the mechanics of fluid flow.
- Analyze and design hydraulic structures such as dams, spillways, and flood control structures.

- Understand the fundamental techniques used in the analysis and design of hydraulic structures for water resources development projects such as reservoirs, dams & appurtenant structures, diversion weirs, and river and watershed management schemes.
- Comprehend the construction, operation, and maintenance aspects of hydropower systems and infrastructure.

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3.2. Core Competencies

The core competencies specific to the civil engineering undergraduate program suggested for the exit exam can be summarized as given in **Table 1**.

Table 1: Core competencies

Learning Domains	Competencies
Knowledge	<ul style="list-style-type: none">• Understand properties of construction materials used in Civil Engineering Projects.• Identify Civil Engineering structures and suitable construction techniques.• Understand working drawings.• Understand construction procurement and contract administration process.• Understand structural design philosophies and procedures.• Know the mechanical properties of Civil Engineering materials.• Understand and use relevant design codes and standards.• Understand structural load types and applications.• Understand basic knowledge of soil properties and characterization.• Understand the basics principles of transport planning and modeling.• Comprehend the design and construction aspects of hydraulic structures.

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Skill	<ul style="list-style-type: none"> • Evaluate Engineering properties of construction materials. • Analyze and solve problems related to construction materials. • Prepare material design for Civil Engineering projects. • Apply different construction techniques. • Interpret and use working drawings. • Prepare specification, estimations and contract documents for Civil Engineering projects. • Interpret and use different standards related to Civil Engineering. • Identify and solve problems related to construction management. • Develop and monitor construction project schedules. • Lead and supervise construction projects. • Analyse and design Civil Engineering structural members (sub and super structures). • Use Computer-Aided Design (CAD) programs. • Perform and interpret geotechnical investigations. • Plan and design highway and transport systems. • Evaluate and select suitable site for hydraulic structures. • Design and supervise hydraulic structure projects.
Attitude	<ul style="list-style-type: none"> ▪ Perform works as a team.

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4. Courses to be Included in the Exit Exam in Different Thematic Areas

The courses to be included in the exit exam for Civil Engineering can be categorized into five main groups based on their content as shown in **Table 2**. These categories don't represent modules and courses in the same category may be found in different modules on the curriculum.

Table 2: Courses to be included in the exit exam

Thematic area	Courses	CrHrs./ECTS
Construction Materials, Building Construction, and Management	1. Construction Materials	3/5
	2. Building Construction	3/5
	3. Contract, Specification and Quantity Surveying	3/5
	4. Construction Management	3/5
Structural Engineering	5. Reinforced Concrete Structures (I & II)	3/5 (each)
	6. Steel & Timber Structures	3/5
	7. Fundamentals of Bridge Design	3/5
	8. Structural Design	3/5
Geotechnical Engineering	9. Soil Mechanics (I & II)	3/5 (each)
	10. Foundation Engineering (I & II)	3/5 (each)
Road and Transport Engineering	11. Transport Engineering	3/5
	12. Highway Engineering (I & II)	3/5 (each)
Hydraulic Engineering	13. Hydraulic Structures (I)	3/5

5. Conclusion

As a conclusion, this draft document was prepared based on the existing curriculums. The document starts with the rationale behind the implementation of the exit exam which is improving the quality of education in Ethiopian higher education institutions. It summarizes the major requirements which are expected from every Civil Engineer upon successful completion of the program. Concerning these requirements, major areas of competencies are described and courses that focus on these competency areas are selected. These courses can be taken as the major focus areas in the preparation of exit exam for students who have finalized their study in Civil Engineering in the undergraduate program.

Due to its broad discipline behavior, civil engineering undergraduate program contains many courses categorized under different specific fields of study. From the courses included in the curriculum, 17 courses were selected as focus areas for the preparation of exit exam. Common and some compulsory and elective courses of the program were excluded from the focus areas for the exit exam preparation for civil engineering graduates.

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