



Ministry of Education

**Identified Competency Focus Areas and Core Courses for
Ethiopian Higher Education Institutions' Exit Examination**

Program: - Construction Technology & Management in BSc.

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

1. Introduction

Starting from 2015 E.C, the Ministry of Education is introducing an exit examination for most of the undergraduate programs in the universities of Ethiopia.

Technology faculties/institution are the primary trained human resource producers who are responsible for designing and constructing infrastructures. Most of mankind's economic, social, political, environmental and public reforms and day-to-day activities are dependent on the infrastructures delivered by the Construction Industry. The same is true in Ethiopia that as a developing country, there is a construction boost and related problems of construction management even if research is required to figure out precisely.

It is said that around 60% capital budget is allocated to construction projects in developing countries. Hence, the importance of the Construction Technology and Management program in managing the huge capital budget allocated to construction and solving the construction problems is boldly visible to construction stakeholders. Taking into consideration the necessity of the program, visionary academicians and other concerned parties opened the program at BSc level in Ethiopia in 2002 in the formerly called 'south technology compass under Addis Ababa University', currently called 'EiABC'. Now the program is opened in around 24 universities of Ethiopia.

In particular terms, Construction Technology and Management has a great role to play in supporting economic development and contributing towards the improvement of the living standard of the people in Ethiopia and elsewhere. As a country that is moving into a rapid phase of growth, the contribution that construction technology and management can make, to ensure that this growth is sustainable; is a particularly important one.

It is therefore of vital importance that construction technologists and managers are professionally prepared to meet this growth challenge and contribute to sustainable development. Hence, the exit exam might contribute towards the professional preparedness and capability of CoTM graduating students.

1.1 Objectives of the exit exam

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 public administration and development management (PADM)
- Ensuring whether the graduation profile of PADM curriculum have achieved at least common standards of knowledge and practical skills
- Improving public trust and confidence in public administration activities of professionals
- 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
- Creating competitive spirit among PADM departments in Ethiopia with the vies to encouraging them to give due attention to the national standards

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 profile of CoTM graduates

- Ability to apply knowledge of mathematics, statistics, science, management, economics, and engineering.
 - Ability to design, construct, and supervise different construction engineering works, as well as to analyze and interpret data.
 - Ability to function on multi-disciplinary teams.
 - Ability to identify, formulates, analyze and solve construction sector problems.
 - Understand professional and ethical responsibility.
 - Ability to communicate effectively.
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- Knowledge of up-to-date issues.
- Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- Understanding and working knowledge of safety and environmental aspects of construction technology & management practices.
- Able to develop effective planning systems of project management to improve productivity.
- Be able to conduct experiments, basic and applied research in relation to construction industries to solve various organizational and social problems.
- Ability to teach the fundamentals of construction technology & management courses.
- Keep abreast of new technologies in construction technology & management. Also to provide orientation and/or training to subordinates as required.
- Able to apply state-of-the-art software in construction management.

3. Competencies and learning outcomes

3.1 Core Learning Outcome

The main learning outcome of the COTM program students is to manage construction projects successfully through the application of knowledge, skills and attitudes learned during their stay by contributing to the development and construction of projects as per required quality, cost (Budget), completing on time and keeping safety for workers, the general public, end users and environment.

3.2 Expected Competencies

Professional competence is understood as the all-encompassing, internalized capability to offer lasting performance in a particular program. The CoTM program's main goal is to prepare professionals for managing construction projects with an effective management system, handling contracts, and conducting research to find better solutions to problems that actually arise on the job site with regard to construction management, methods, and materials and equipment management. The program will produce managing engineers who are highly qualified and knowledgeable in the fields of structural, geotechnical, and highway engineering. Graduates will also have a thorough understanding of construction technology and project management skills, enabling them to actively participate in the development,

planning, and management of construction and infrastructure projects. The following list of competencies can be used to summarize a Construction Technology and Management professional:

3.2.1. Construction Engineering Related Competence

This competency covers the basic understanding of Architectural and Engineering design methods and processes of buildings and other structures.

I. Knowledge

- To understand the concepts of structural design
- To know the basic mechanism of reinforced concrete structure elements
- To identify different types of dams, their various components, design and construction concepts.
- Understand the planning and working principles of hydropower systems.
- To understand the concepts of foundation engineering.
- To identify causes and problems associated with expansive soil and find remedial measures.
- To understand the essential components of a highway and basic elements of highway engineering and geometric design components.
- To know material properties, testing procedure, and asphalt mix design.
- Basic understanding of architectural and engineering design methods and processes.

II. Skill

- The ability to design basic elements of reinforced concrete structures.
 - Determine the force acting on the dam and analyze its stability, ancillary structures (spillway, energy dissipater, outlet works), and river diversion during construction.
 - Determine various components of irrigation structures, methods, and efficiencies.
 - To plan and execute soil investigation programs.
 - To design footing and retaining structures conforming to standards.
 - To design highway and asphalt mix.
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3.2.2. Construction Technology Related Competence

This competency covers the methods, technologies and processes of construction of buildings and other structures. Candidates should have a clear understanding of the design and construction processes commonly used in the industry such as; applying practical and scientific knowledge of construction, conduct setting out, understanding the construction process, methods, and techniques, identifying required materials and equipment, and ability to communicate through writing, and graphical and technical drawing.

I. Knowledge

- To understand the production, nature, and characteristics of different construction materials and identify them with respect to their suitability to different engineering structures based on their properties.
- To know the processes involved in the production of concrete, and the properties of concrete to conduct tests over fresh and hardened concrete
- To comprehend the use of metals and alloys as construction materials
- Comprehend the construction aspects of foundations, walls, walls, floors, staircases, doors and windows, lintels, arches, roofs, roof coverings, plastering, finishing, RC, and steel framed structures. Comprehend the construction aspects of joints in structures.
- Knowledge of the recent advances in construction technology and a basic grounding on BIM technology and its benefits, potential applications in the construction industry, and likely implementation issues.
- To have practical and scientific knowledge of construction, process, methods, techniques, materials, and equipment.

II. Skill

- To identify different types of construction materials and their properties that are currently applied in the construction industry and also know how to test.
 - To perform concrete mix design for the production of concrete
 - To construct different types of construction, knowing the different types of methodology with different types of construction materials
 - To prepare component design, execute and supervise the developments of building components. And initiate effective methods to manage building projects
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- Ability to develop standard building construction details.
- able to know different concepts of Cost-efficient Construction and involve them with the Modern Construction Technology
- The ability to communicate through writing, graphical, and technical drawing.
- The ability to take samples, conduct material tests (laboratory and field tests), and accept and reject results as per the standards.

3.2.3. Construction Management Related Competence

I. Knowledge

- To understand project life cycle and life cycle cost of the project.
- To know how to manage resources allocated for the specific project optimally.
- To know the design requirements, how to prepare specifications, quantity surveying, and estimating the cost of construction projects.
- Plan and organize resources including human, equipment, and material resources with an efficient management system.
- Read, analyze, and understand technical drawing and specification
- Conduct inspection and supervision by checking and measuring works for accuracy and fit to the specification.
- Components and techniques of cost estimation and unit rate analysis detected identify design problems.
- To know functions & goals of financial management including financing decisions to means of financial securities, short and long-term financing of construction projects, dividend decisions & policy, firms
- To understand the financial operation of firms through financial statement & analysis, working capital management, investment policy: project appraisal, capital budgeting, a system of monitoring & control

II. Skill

- To coordinate and control the overall activities of the project from inception to completion using resources effectively and efficiently with the satisfaction of the stakeholders.
 - prepare takeoff sheet, specifications, and bill of quantity for different trade of works complete planning and organizing works
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- The ability to conduct project appraisal, cash flow forecasting and analysis
- Prepare a different schedule of resources and cash flows.
- Adopt construction materials, equipment, machinery, and other advanced technological outputs to local needs.
- To prepare project cost estimation
- Ability of completion of works within estimated budget and specified time,
- Ensuring necessary quality of the work by planning ahead and conducting inspection and tests
- Proper usage of equipment and latest methods of construction and modern technology,
- Ability to control the contract agreed upon and specification,
- Motivating people to work to their best and creating an organization that works as a team,
- Taking sound decisions at respective management levels,
- Proper communication and reporting of the works executed,
- Provisions of safe and satisfactory working conditions for all workers,
- Evaluating performance of executed construction works against plan,
- Understanding and analyzing the proper sequence of flow of construction works,
- To prepare contract documents and the capacity to evaluate the bid.
- Ability to prepare or evaluate payment certificates
- Ability to use different scheduling tools such as Primavera & MS project
- Ability to negotiate and conflict handling, and
- Ability to risk identification and analyze its effect

III. Attitude(for all competencies)

- Entrepreneurship that encourages creative and proactive actions
 - Commitment to the ethics and to the individuals and organization's goals
 - Curiosity that encourages continuous learning and developing
 - Developing a strong sense of integrity(Honesty and rightness)
 - Consideration for the need of for others (thoughtfulness)
 - Optimism committed, tenacity, and flexible
 - Respect and tolerate the rights and values of others
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- Accuracy and self-discipline in keeping with the implications of safety, public health, and welfare, as well as interdependence within and between project teams and with project stakeholders.
- Developing high moral standards
- Developing a positive attitude towards the work and the team member
- To develop professional and work ethics in design and construction.
- Believe and carefully apply scientific skills and knowledge during the physical erection of structures.
- To visualize and forecast the consequence of ignorance and tolerance engineering and construction decisions on safety and aesthetics.

4. Course Lists and Categorizing Courses into Themes

The Ministry of Education suggests that the exit exam should contain 10 to 15 Courses from a given program. However, the team strongly believes at least the listed 16 courses are mandatory to measure the competency of undergraduates. The working team has identified the following 16 courses into 4 themes that can be included in the exit exam in Ethiopia starting from the 2015 E

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.Construction Engineering courses (25%)	C r h s	EC TS	Construction Technology (19%)	Cr hr s	ECTS	Construction Planning, Estimating and controlling (37%)	Cr hrs	EC TS	Construction Supervision and contract administration (19%)	Cr hrs	ECTS
Design of Reinforced Concrete Structures	3	5	Construction Materials I & II	6	10	Construction Specification and Quantity Surveying	4	6	Health and Safety Management in Construction	3	4
Design & Construction of Water Works	3	5	Building construction, I & II	6	10	Financial Management in Construction	3	5	Construction Procurement and Contract Management	3	5
Highway Engineering, I & II	6	10	Modern Construction Technology and BIM	3	5	Construction Equipment & plant management	3	4	Construction site supervision	2	4
Foundation Engineering	3	5				Cost Engineering	3	5			
						Construction Planning and Scheduling	4	6			
						Construction Performance & Resource Optimization	3	5			
Total	15	25		15	25		20	31		8	13
Overall total of 15 Courses Cr hrs./ECTS in Exit Exam						___56___ Cr hrs.			_90_ ECTS		
Total Cr hrs./ECTS in the COTM program						___188___ Cr hrs.			___310___ ECTS		

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5. Conclusion

The proposed exit exam might help students to provide attention to the above major and more important courses in Construction Technology and Management Program that can drive them to acquire the above-mentioned competence and others. The working team has identified 16 core and major courses for the exit exam which are categorized in four areas namely Construction technology (19%), Construction Engineering (25%), construction planning, estimating and controlling (37%), and Construction Supervision and contract administration (19%) themes based on the MoE Curriculum.

Moreover, it is believed that this list of exit exam courses are prepared to serve as a starting point and so many individuals or universities would develop it further and validate it. In addition, the content of this exit exam document will be subjected to revision whenever the curriculum is revised or when the need to change arises from stakeholders.

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Appendix

MOSHE Curriculum

No.	Course Name	Cr. hr.	ECTS
1	Communicative English Language Skills I	3	5
2	General Physics	3	5
3	General Psychology	3	5
4	Mathematics for Natural Sciences	3	5
5	Critical Thinking	3	5
6	Physical Fitness	-	-
7	Geography of Ethiopia and the Horn	3	5
8	Communicative English Language Skills II	3	5
9	Social Anthropology	2	4
10	Applied Mathematics I	3	5
11	Introduction to Emerging Technologies	3	5
12	Moral and Civic Education	2	4
13	Computer Programming	3	5
14	Entrepreneurship	3	5
15	Principles of Accounting	3	5
16	Engineering Mechanics	3	5
17	Engineering Drawing	3	5
18	Workshop Practice	2	4
19	Construction Materials I	3	5
20	Economics	3	5
21	Introduction to Management	3	4
22	Building Construction I	3	5
23	Construction Materials II	3	5
24	Construction Drafting and Working Drawing	3	5
25	Computer Aided Drafting	2	4
26	Strength of Materials	3	5
27	Hydraulics	3	5
28	Principles of Construction Management	3	4
29	Building Construction II	3	5
30	Theory of Structures	3	5
31	Water Supply and Treatment	3	4
32	Soil Mechanics	4	6
33	Surveying	4	6
34	Probability & Statistics and Data Analysis	2	4
35	Architectural Planning and Design	3	5

No.	Course Name	Cr. hr.	ECTS
36	Design of Reinforced Concrete Structures	3	5
37	Sewage Disposal & Treatment	3	5
38	Foundation Engineering	3	5
39	Highway Engineering I	3	5
40	Construction Specification and Quantity	4	6
41	Surveying		
42	Construction Equipment and Plant Management	3	4
43	Highway Engineering II	3	5
44	Construction Site Supervision	2	4
45	Construction Planning & Scheduling*	4	6
46	Cost Engineering	3	5
47	Design and Construction of Water Works	3	5
48	Human Resource Management in Construction	3	5
49	Construction Law	3	5
50	Technical Report Writing & Research Methods	2	4
51	Health and Safety Management in Construction	3	4
52	Internship	8	12
53	Financial Management in Construction	3	5
54	Bridge and Tunnel Construction	2	4
55	Construction Procurement and Contract	3	5
56	Management		
57	Development and construction Economics	3	5
58	Design of Steel and Timber Structures	3	5
59	Holistic Project and Introduction to Construction	4	6
60	Construction Performance & Resource. Optimization	3	5
61	Modern Construction Technology and BIM	3	5
62	BSc. Research	5	8
63	Global Trends	2	4
64	Inclusiveness	2	4
65	Elective	2/3	4/5

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