



**Ministry of Education**

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

Program: - Bachelor of Science in **Computer Science**  
Animal Sciences Graduates To Be Held In 2015 E.C  
Competencies & Courses suggested For Exit Examination For  
Animal Sciences Graduates To Be Held In 2015 E.C

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# 1. Introduction

We live in the digital age, where computers pervade every aspect of our daily lives. It is believed that the potential of computers and the benefits they can bring to society are only just beginning to be realized. Computer scientists are at the forefront of figuring this out, with the goal of improving existing solutions as well as developing entirely new ones. The development of theories, as well as the design and implementation of software and hardware solutions, all necessitate the involvement of computer scientists. As a result, universities both locally and globally teach computer science in an effort to produce the scientists and engineers of tomorrow.

Most Ethiopian higher education institutions offer computer science as a four-year degree program, with the goal of contributing to the country's overall growth by producing needed manpower. In line with this, to avoid irregularities on the graduation profile a harmonized curriculum is in practice which is implemented across all universities. The curriculum states that the minimum requirement for graduation is a CGPA of 2.0, which does not measure the overall learning output of the program but rather individual courses. As a result, a framework that guarantees the fulfillment of the curriculum's graduate profile, as well as the production of qualified labor for the local, national and international markets is needed. To this end, the Ministry of Education (MoE) devised an exit exam as a framework to achieve the aforementioned and other goals, such as creating a conducive environment for stakeholders' proper engagement and assessing students' achievement in their major area.

There are various settings in which an exit exam may be defined. In our case, it is described as a form of assessment that higher education institutions utilize to examine the basic level of competency obtained by its students. It is an assessment that is given to students towards the end of their higher education tenure. Exit exams, according to studies [1], improve student performance, have a positive impact on the job market, and result in faster economic growth. As a result, computer scientists who have completed their higher education can use the exit exam to demonstrate that they have the skills, knowledge, attitudes, and general competencies required by stakeholders worldwide.

First and foremost, this competency and exit exam guideline for the BSc degree in computer science program at higher education institutions in Ethiopia outlines the expected profiles of graduates, such as knowledge, skills, and attitudes. The core competencies are then identified and their course mapping is presented. The courses to be included in the exam are then listed and organized into themes. Finally, concluding remarks are communicated.

## **2. Expected profiles of graduates**

The three profiles of knowledge, skills, and attitudes are universally acknowledged as being necessary for graduates [2].

- Knowledge ("know-what") is the mastery of fundamental ideas and concepts as well as the application of learning to new situations
- Skills ("know-how") is the ability to complete tasks with predictable outcomes
- Attitudes ("know-why") are intellectual, social, or moral tendencies

## **3. Competencies and learning outcomes**

### **3.1. Core competencies**

The term competency refers to workplace performance, or what a graduate should bring to a job. The concept glues together the above mentioned expected graduate profiles, i.e., Competency=Knowledge + Skills +Attitudes. The core competencies for computer science graduates are listed as follows:

- Design a computer system application, process, or protocol to meet the requirements of users or stakeholders.
- Use a variety of operating systems, programming languages, and software tools effectively.
- Use formal reasoning to justify the correctness of computer science results
- Manage and administer computing systems and resources
- Identify any risks or safety issues that may be involved in the operation of computing equipment in a given context.
- Evaluate systems in terms of general quality attributes and potential tradeoffs presented within the context of the given problem.

- Create a substantial technical document that describes work and plan of a project.

Specifically, in addition to the above mentioned competency areas the expected graduates of computer science graduates need to have the following competencies:

### **3.2. Knowledge**

Graduates of computer science are expected to understand both the theoretical and practical aspects of field, as well as the role of computing systems in general. To this end, the ability to apply or justify concepts, methods, and computational proficiency in the field is required. It is, therefore, critical to have comprehensive knowledge and understanding of the following topics:

- The fundamental concepts, principles and theories of computation and the application of computers.
- Software Fundamentals and programming languages
- Systems architecture and infrastructure
- Systems modeling
- Structuring of data and information
- Hardware
- Trends and developments in computer science

### **3.3. Skills**

The following skills are also expected from computer science graduates:

- Remembering emerging technologies
- Understanding computer architecture and operating systems
- Applying programming languages and software tools to address issues in the real world
- Analyzing existing computing infrastructures and architectures
- Evaluating systems in terms of general quality attributes and potential tradeoffs
- Creating computer artifacts to solve societal problems by applying system modeling, development, and implementation principles

### 3.4. Attitudes

Graduates of computer science are expected to have a wide range of transferable skills (attitudes), including

- Teamwork: Capable of making a valuable contribution to a development team.
- Communication: Briefly explain technical problems and how to solve them to a range of audiences.
- Handling Ethical Issues in Computer Technology: Recognize and follow the social, professional, and ethical issues that arise from the use of computer technology.

### 3.5. Mapping between core Competencies and Selected Courses

The mapping of core competencies to core courses is shown in Table 3-1. Competency, as previously stated, is expressed in terms of knowledge, skills, and attitudes. The skills are described using Bloom's levels of skill [3], which are composed of six cumulative degrees of skills including remembering, understanding, applying, analyzing, evaluating, and creating.

Table 3-1 Mapping of core competencies to courses

Competency Vs Courses		Computer Programming	Object Oriented Programming	Web Programming	Data Communication and Computer Networking	Wireless Communication and Mobile Computing	Computer Security	Network and System Administration	Fundamentals of Database Systems	Advanced Database Systems	Software Engineering	Introduction to Emerging Technologies	Introduction to Artificial Intelligence	Design and Analysis of Algorithms	Data Structures and Algorithms	Operating System	Computer organization and architecture
Knowledge Element	Skills																
Programming Languages	Understanding, Applying	X	X	X													
Structuring of data and information	Analyzing								X	X					X		
Systems Modeling	Evaluating,										X						

	Creating																
Systems architecture & infrastructure	Analyzing, Evaluating				X	X	X	X					X			X	
Software development	Applying, Creating			X					X	X	X						
Software Fundamentals	Understanding, Applying	X	X	X					X	X						X	
Hardware	Understanding, Remembering																X
Concepts, principles and theories of computation and the application of computers	Understanding, Remembering	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X
Trends and developments in computer science												X	X				

#### 4. Courses to be included in the exam

No	Curse Code	Course Name	ECTS
1	EmTe1012	Introduction to Emerging Technologies	5
2	CoSc1011	Computer Programming	5
3	CoSc2041	Fundamentals of Database Systems	5
4	CoSc2041	Advanced Database Systems	5
5	CoSc2051	Object Oriented Programming	5
6	CoSc2022	Computer organization and Architecture	5
7	CoSc2032	Data Communication and Computer Networking	5
8	CoSc2092	Data Structures and Algorithms	5
9	CoSc3081	Web programming	7
10	CoSc3034	Wireless Communication and Mobile Computing	5
11	CoSc3023	Operating System	5



12	CoSc3061	Software Engineering	5
13	CoSc3094	Design and Analysis of Algorithms	5
14	CoSc3112	Introduction to Artificial Intelligence	5
15	CoSc4035	Computer Security	5
16	CoSc4036	Network and System Administration	5
<b>Total</b>			<b>82</b>

A computer science graduate should take 52 courses to graduate, according to the current curriculum. However, including all courses in the competency and exit examination is unrealistic. To that end, the following courses were chosen from among all available options for the competency and exit examination.

Table 4-1: List of selected Courses

## 5. Categorizing courses into themes

Table 5-1: Courses organized into themes

Theme	Courses
Programming and Web Development	Computer Programming
	Object Oriented Programming
	Web Programming
Computer Networking and Security	Data Communication and Computer Networking
	Wireless Communication and Mobile Computing
	Computer Security
	Network and System Administration
System Development and Database Systems	Fundamentals of Database Systems
	Advanced Database Systems
	Software Engineering
Emerging Technologies and Intelligent Systems	Introduction to Emerging Technologies
	Introduction to Artificial Intelligence
Algorithms	Design and Analysis of Algorithms
	Data Structures and Algorithms
Computer Architecture and Operating Systems	Operating System
	Computer organization and architecture

## 6. Conclusion

Core competency and exit examination courses for the computer science BSc degree program were presented in this guideline. Sixteen courses were chosen from a pool of more than 52 courses to assess students' competencies. The courses are further categorized into six themes

for comprehension purpose. The courses on the list are fundamental courses that prepare students to compete in the global marketplace.

The exam that is going to be prepared from these courses should focus on concepts that guide for long term knowledge and transfer skills instead of detailed assessment. Furthermore, the courses are subject to change in the event of a curriculum update.

## **References**

- [1] Woessmann, Ludger. "Central exit exams improve student outcomes." IZA World of Labor (2018).
- [2] Clear, A., A. Parrish, J. Impagliazzo, P. Wang, P. Ciancarini, E. Cuadros-Vargas, S. Frezza et al. "Computing curricula 2020 (CC2020) paradigms for global computing education." ACM: New York, NY, USA (2020).
- [3] Anderson, L.W. et al., A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives, abridged edition, (White Plains, NY Longman, 2001).