

**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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# Introduction

With the ever-changing demand of the software engineering professionals in various local and international industries, it has become to produce graduates equipped with the required knowledge, skill and attitude needed by the industries. This has necessitated the need to evaluate the knowledge, attitude and skill set of the software engineering graduates using the identified competencies and focus areas of the software engineering curriculum and against the ever-increasing industry demands of this program.

Software engineering program, being one of the ever evolving and demanded program in this era, should strive to align itself to this objective. The stakeholders who are taking part in this program should mandate themselves in working towards ensuring the knowledge, attitude and skill set of its graduates against these core competencies and quality objectives.

The benefit of evaluating and certifying the software engineering graduates against the identified competencies and focus areas are manyfold. It helps to certify the graduates based on the competency requirements of the software engineering, to win the trust of the industries to consume and employee the graduates and to introduce a sense of hard work in the mindset of the graduates early in their academic years thereby enabling them to explore and dig further for the relevant skill sets of software engineering program that is needed by the market.

The intent of this draft document for software engineering is to provide a framework within which to conceptualize the competency areas that should be covered and addressed by the exit exam to be prepared in the future. This document comprises of list of core courses that are expected to measure the student’s competency in the software engineering program. For simplicity and better management of the competency areas, the courses have been clustered into themes. Overall, the software engineering exit exam for Ethiopian higher institutions have been prepared ultimately aiming to, maintain the program and graduates quality through evaluating graduates against the curriculum objectives so as to increase local and international industries trust on our graduates.

# Expected Profile of the Graduate

This exit exam is expected to measure the software engineering graduates knowledge, skill and attitude so that they:

* Understand professional, ethical, legal, security and social issues and responsibilities.
* Have ability to apply knowledge of computing and mathematics to resolve on-hand and upcoming problems.
* Have recognition of the need for, and an ability to engage in, continuing professional development and the knowledge and skills to act as research assistants or lecturers in higher education institutions
* Use current techniques, skills, and tools necessary for software development, testing, and maintenance.
* Have the knowledge and innovative skills to plan, set up and run software related businesses.
* Understand best practices and standards of software engineering program and their application.
* Have the required software project management skill that enable them to manage complex software projects.

# Competency and Learning Outcome

Software engineering graduates are expected to demonstrate the following knowledge, skill and attitudes:

* Apply knowledge of mathematics, computing science, engineering fundamentals and software engineering specialization to address complex and large-scale problems.
* Identify, formulate, research literature, and analyze complex problems, reaching substantiated (justifiable, validated) conclusions using software development principles, methodologies, and tools.
* Design integrated and efficient software solutions, component, or processes to address complex problems and implement them to meet the specified needs with appropriate consideration for public health and safety, cultural, societal (local and international) and environmental considerations.
* Conduct investigation of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions
* Adopt, innovate, select, and apply appropriate state of the art software design and development tools, methodologies, resources, and emerging technologies including simulation, prediction and modeling for complex business process with understanding of their potential capabilities, limitations and associated risks.
* Apply logical reasoning and informed decision to assess societal, health, safety, privacy, security, legal and cultural issues, and the consequent responsibilities relevant to software engineering application
* Understand the impact of software applications in societal and environmental contexts and apply the principle of green computing for sustainable development.
* Apply ethical principles and commit to professional ethics and responsibilities and norms of software engineering practice.
* Function effectively as an independent software engineer, as a member or as a leader in a diverse team and multidisciplinary settings.
* Communicate effectively on complex business and system activities with the software engineering community and with a society at large; such as being able to comprehend and write effective reports, articles and design documentations using various tools, make effective presentations and give and receive clear instructions.
* Demonstrate knowledge and skill on software project management principles and apply these to manage software development processes and its resource requirements, costs in multidisciplinary projects
* Recognize the need for and have the preparation as well as ability to engage in an independent and lifelong learning in the information and knowledge economy

# Courses to be included in the Exit Exam

Following the identification of the core competency areas based on the software engineering curriculum core competency areas, we have identified the courses which could help achieve the identified competencies. Accordingly, the following courses have been identified to be included in the software engineering exit exam.

* Computer Programming
* Operating System and s System Programming
* Fundamental of Data structure and analysis
* Object Oriented Programming
* Fundamentals of Software Engineering
* Web Design and Programming
* Mobile Application Development
* Computer Organizations and Architecture
* Human Computer Interaction
* Fundamentals of Cybersecurity
* Fundamentals of Artificial Intelligence
* Fundamentals of Database
* Fundamentals of Networking
* Requirement Engineering, Architecture and Design
* Software Testing, Verification and Quality Assurance
* Software Project Management

# Categorizing courses into themes

To help demarcate the focus areas and competency boundaries that are covered by the identified courses, the courses have been categorized under six themes. Accordingly, Table 1 maps courses to the respective themes identified.

Table 1: Courses categorization based on themes

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S/N** | **Themes** |  | **Courses**  | **ECTS** |
| 1 | Problem analysis and programming  | 1 | Computer Programming | 7 |
| 2 | Fundamental of Data structure and analysis | 7 |
| 3 | Object Oriented Programming | 7 |
| 4 | Web Design and Programming | 7 |
| 5 | Mobile Application Development | 5 |
| 6 | Fundamentals of Database | 5 |
| 2 | Networking and Software Security | 7 | Fundamentals of Networking | 5 |
| 8 |  Software and information security | 5 |
| 3 | Software requirement, Design, and construction | 9 | Fundamentals of Software Engineering | 5 |
| 10 | Requirement Engineering, Architecture and Design | 7 |
| 11 | Human Computer Interaction | 5 |
| 4 | Software project management and quality assurance | 12 | Software Project Management | 5 |
| 13 | Software Testing, Verification and Quality Assurance | 7 |
| 5 | Operating system and computer organization | 14 | Operating System and System Programming | 7 |
| 6 | Miscellaneous | 15 | Artificial Intelligence  | 5 |

# Conclusion

It is crystal clear that evaluating the graduates against the core competencies set out by the curriculum and inline with the industry needs would be important to boost the trust of the employers on the graduate’s skill. To realize this, it has become to have a guideline that could be used as reference to prepare a comprehensive exit exam that could address the relevant focus areas of the program.

To this end, this document was prepared with the intent to highlight the core competency areas of software engineering curriculum, taking in to account about anticipating market demand of the software engineering professionals sought by the local and international industries and to assess the graduate’s knowledge, skill and attitude.

Finally, the outcome from the software engineering exit exam could be used as a feedback loop for policy makers. It is believed that the outcome from the exit exam would be significant and be used as input for policy makers who are engaged in curriculum development based on the exit exam outcomes of the graduates by modifying or incorporating new competencies in to the curricula and taking other remedial actions that might improve the software engineering graduates.