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

Program: - BSc in Water Resources and Irrigation Engineering

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1. Introduction

A study of Water Resources and Irrigation Engineering is a field of study that deals with collecting and distributing water where and when it's needed. The field gives greater emphasis to

irrigation Engineering and drainage systems, river training and flood protection works, construction of dams and reservoirs for water supply and irrigation purposes as a whole. Undergraduate studies offer a series of basic engineering and applied courses in the area of water resources, irrigation and water supply engineering (fluid mechanics, hydraulics, hydrology, ground water, water supply and wastewater systems, irrigations and drainage, river hydraulics, sedimentation, river-training works, flood protection etc.). The program also offers Civil-engineering courses, which includes elements of geo-mechanical engineering, structural engineering, construction engineering, materials engineering, transportation engineering, geodesic surveying and geology.

Ensuring quality and relevant education in Higher Education institutions is one of the challenges that remained to be solved. In a pursuit to rise educational outcomes in terms of quality and relevance, many countries currently aim to improve accountability in the school system. Many school systems provide educational outcome information. However, the Exit exam provides outcome information to be comparable across schools on an external standard.

Moreover, several concerns regarding the scheme of exit exam including efforts and costs to maintain the process, opposing arguments, exposing potential weakness in the education system, fear of impeding flexibility within curriculum, quality and reliability of the employee, ownership, exam administration, and management and cheating will be considered.

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 Water Resources and Irrigation Engineering (WRIE)
- Ensuring whether the graduation profile of WRIE 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

- Creating competitive spirit among WRIE 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;

The primary purpose of the exit exams is to assess students' educational achievement in the major area of program study. The exam is supposed to measure the learning outputs of the program as a whole not the individual courses. Exit exams have been argued to improve the signaling of educational achievement on the labor market and to increase labor-market productivity through human capital. The exit exam is intended to ensure all graduates from HEIs have developed adequate mastery of the core competencies articulated in the respective curricula thereby satisfying the requirements of the labor market and employability through the nationwide implementation of curriculum-based exit examination.

2. Expected Profile of Graduates

This program is aimed at training manpower required for the realization of the use of country's vast water resources potential. Well-qualified Water Resources and Irrigation Engineers will be

produced through this program who can actively be engaged in the planning, design, development and management of water resources projects. Specifically, the trainees will be equipped with the knowledge that enables them to execute the following tasks:

- Undertake project identification; pre-feasibility and feasibility studies of water resources projects;
- Plan water resources projects; and design irrigation, drainage structures and other related to environmental protection works;
- Prepare complete contract documents for water resources projects like, Irrigation projects, drainage facilities, water supply projects, and projects which are related with environmental protection works;
- Plan, design, manage and supervise the construction of Irrigation, drainage structures and related civil engineering works;
- Plan, design, manage, monitor and evaluate the operation and maintenance of irrigation and drainage systems;
- Remodeling and rehabilitation of existing water supply, hydraulic and hydropower systems.

3. Competences and Learning Outcomes

3.1. Competences in terms of Knowledge

Upon successful completion of the B.Sc. study program, the graduate of B.Sc. degree in Water Resources and Irrigation Engineering will acquire all the necessary skills and capabilities, which enable the degree holder to plan, design, construct, operate and manage facilities and structures for:

- Optimum utilization of available water resources for irrigation, industrial and domestic water supply systems etc.
- Natural water flow control such as flood control, land drainage etc.

3.2. Competences in terms of Skill

The graduate is able to participate and professionally perform engineering services in the different water resources and irrigation projects phases along the project cycle, including the following skills:

- Identification of water resources and irrigation problems of existing infrastructure and elaboration of technically and economically feasible concepts for their solution:
- On-site surveys, pre feasible and detail designs specifications of irrigation and water resources projects
- Preparation of bills of quantities and construction documents
- Assistance in the tender process and contract administration
- Construction supervision, control and approval of contractors' documents and settlement of claims and disputes
- Operation, management and long-term quality control of water infrastructure
- Training of operational technical staff

The graduates will have the capacity to innovate, transfer technology & entrepreneurship. He/she can understand the way of creating new business idea, competitiveness contributes to new business products, and also the entrepreneurship traits and skills needed in entrepreneurship. Furthermore, the B.Sc. degree in Water Resources and Irrigation Engineering as the first academic degree may also be the starting point for further academic qualification as for example in the framework of post-graduate studies in various water related fields such as:

- Irrigation and Drainage Engineering
- Irrigation Engineering and Management
- Hydrology and Water Resources Engineering
- Groundwater Engineering
- Hydraulic and Hydropower Engineering
- Water Supply and Environmental Engineering
- Water Resources Engineering and Management
- Hydro-Informatics
- Hydraulic Engineering and River Basin Development
- Integrated River Basin Management
- Soil and Water Conservation Engineering
- River Engineering

3.3. Competences in terms of Attitude

The graduate this program will able to have the following attitude on the study of the program;

- ⇔ Attitude about entrepreneurship on the program and create a job
- ⇔ Integrated Water Resources Management
- ⇔ An Attitude of Perception on water availability and utilization of this resources for sustainable development
- ⇔ Attitude of making citizen of Ethiopia to be food self-sufficient by applying Irrigation rather than rainfed agriculture by construction of Water Resources Structures
- ⇔ Since there is a limited Water Resources, an attitude of using this in a well conservative and optimizing them.

4. Selected Courses to be Included in the Exam

The study program consists of ten semesters with the following sequence: two freshman semesters, five basic studies semesters, one internship semester, and two semesters for project-based studies. The program comprises 17 modules and 68 courses that can equip students with relevant knowledge, skills and attitude to effectively carry out their future duties and responsibilities with courses from diverse fields that include mathematics and natural sciences, field-specific basic sciences, field-specific specialization, non-field specific subjects, and practice-based studies.

From the curriculum, some major courses and that have direct impact on the study were included for the selection of the courses. The following table shows the courses to be included in the exam. The selection of the courses was triggered and directly related to the career of the trainee.

SN	Selected Courses for the Exit Exam	Credit Hour in ECTS
1	Hydraulics II	5
2	Construction Materials and Equipment	3
3	Open Channel Hydraulics	5
4	Surface Water Hydrology	5
5	Groundwater Hydrology	4
6	Surface Irrigation	5
7	Pressurized Irrigation	4
8	Drainage Engineering	5
9	Dam Engineering -I	5
10	Dam Engineering -II	4
11	Irrigation Structures	6

SN	Selected Courses for the Exit Exam	Credit Hour in ECTS
12	Water Supply Engineering	4
13	Water Resources Planning and Management	4
14	River Engineering	4
15	Construction Planning and Management	4

5. Categorizing Courses in to Themes

This is basically focused on the courses that will be categorized based on the curriculum of the program as of the following table.

SN	Courses' Theme	Selected Courses for the Exit Exam	Remarks
1	Construction Technology Management	Construction Planning and Management	
		Construction Materials and Equipment	
2	Engineering Hydrology	Surface Water Hydrology	
		Groundwater Hydrology	
3	Fundamental of Hydraulics	Hydraulics II	
		Open Channel Hydraulics	
4	Hydraulic Structures	River Engineering	
		Dam Engineering -I	
		Dam Engineering -II	
5	Irrigation and Drainage Engineering	Surface Irrigation	
		Pressurized Irrigation	
		Drainage Engineering	
		Irrigation Structures	
6	Water Resources Study, Planning and Management	Water Resources Planning and Management	
7	Water Supply and Sanitation Engineering	Water Supply Engineering	

6. Conclusion

Many states use high school exit exams as a means of maintaining graduation standards across public high schools. In these states, exit exams are required for all public-school students, and must pass them to earn high school diploma. Therefore, exit examination in Higher Educations in Ethiopia will be important for gaining their certification and degree.

It is believed that to bring quality and supportive education, letting of curriculum based an exit examination in university will bring a change on the quality.

Exit exam for graduate students will assesses a student's overall understanding of their educational experience. This helps that the students can easily identify their professional focus area when they do their career. Based on the above considerations, this specific document was prepared and the course selection was made to have a well-qualified manpower for measuring their knowledge, skill and attitude for the industry.

For proper manipulation of the exit exam, establishing independent exit exam organization like Ministry of Education by online exam administration, awareness creation before full implementation of exit exam and identifying each stakeholder's role are some of the recommendations forwarded.

7. Appendix

Appendix A: List of Water Resources & Irrigation Engineering Degree Program Courses & Module Category from Curriculum

						Credit Point in ECTS				
Number	**Module Code**	**module Name**	**Credit Points in ECTS**	**Course Code**	**Course Name**	Total ECTS	L	T	L /	HS
01	FLEn1013	Communication	10	FLEn1011	Communication	5	3	2		4
				FLEn1012	Basic Writing Skill	5	2	3		3
02	Phil1023	Logic and Reasoning Skill	3	Phil1021	Logic and Reasoning Skill	3	2	0		3
03	Cvet1023	Civic & Ethical Education	5	Cvet1031	Civic & Ethical Education	5	3	0		5
04	GEng1043	Basic Engineering Skills	12	MEng1041	Engineering	5	2	0		4
				GEng1042	Introduction to Engineering Profession	2	1	0		2
				CEng1043	Engineering	5	2	3		3
05	GEng1053	General Engineering Skills	_	ECEg1051	Introduction to Computer Science and	3	1	0		2
				MEng1052	General Workshop	2	0	0		1
06	Math1063	Applied Mathematics	12	Math1061	Applied	6	3	3		4
				Math1062	Applied Mathematics II	6	2	3		5
07	CEng1071	Surveying	11	CEng1071	Surveying I	5	2	3		3
				CEng2072	Surveying II	5	2	3		3
				CEng2073	Surveying Field	1	0	0		1
08	CEng2081	Structural Analysis	11	CEng2081	Strength of	6	2	3		5
				CEng2082	Theory of Structure	5	2	3		3
09	CEng2093	Geotechnical and Road	21	CEng2091	Soil Mechanics I	5	2	2		3
				Geol2092	Engineering	3	2	0		2
		Engineering		CEng2093	Soil Mechanics	5	2	2		3
				CEng2094	Foundation	5	2	3		4
				CEng2095	Road	3	2	1		2
				CEng3101	Reinforced Concrete Design	5	2	3		3

10	CEng3101	Structural Engineering	14	CEng3102	Reinforced Concrete Design	5	2	3		3
				CEng3103	Design of Steel & Timber	4	2	2		3
11	WRIE5111	Project Planning and analysis	7	WREI5111	Environmental Impact	3	2	0		3
				WREI5112	Project Planning and Management	4	3	1		3
12	CEng2121	Construction Technology	5	CEng1121	Construction Material &	3	2	0		2
				CEng2122	Building	2	2	1		1
13	WRIE2131	Engineering Hydrology	23	Stat2131	Probability and	3	1	2		2
				WRIE2132	Introduction to Hydrology	5	2	2		3
				WRIE2133	Hydrometer	2	1	0		1
				WRIE2134	Surface Water	5	2	3		3
				Math2135	Numerical	4	1	2		3
				WRIE2136	Ground Water	4	2	2		3
14	WRIE2141	Fundamental of Hydraulics	15	WRIE1141	Hydraulics I	5	2	2		3
				WRIE2142	Hydraulics II	5	2	2		3
				WRIE2143	Open Channel Hydraulics	5	2	2		3
15	WRIE3151	Irrigation and Drainage Engineering	25	WRIE3151	Soil Physics	3	1	1		2
				WRIE3152	Surface	5	2	3		3
				WRIE4153	Pressurized	4	2	2		3
				WRIE4154	Irrigation	6	2	3		5
				WRIE4155	Irrigation water	3	2	0		3
				WRIE3156	Drainage	5	2	3		4
16	WRIE3161	Water Supply and sanitation Engineering	16	WRIE3161	Water Quality and Treatment	2	1	0		1
				WRIE3162	Water Supply Engineering	4	2	2		3
				WRIE3163	Sewerage System and Waste Water Treatment	3	1	2		2
				WRIE3164	Water Wells	4	2	2		3
				WRIE3165	Pump Design and Installation	3	1	2		2
				WRIE4171	River	4	2	2		3

17	WRIE3171	Hydraulic Structures	18	WRIE4172	Dam	5	2	3		4
				WRIE4173	Dam	4	2	2		3
				WRIE4174	Principles of Hydropower and Alternative Energy Sources	5	2	3		4
18	WRIE3181	Water Resources study, Planning and Management	23	WRIE3181	Technical Report Writing and Research Methods in WRIE	3	2	0		3
				WRIE3182	Soil and Water Conservation Engineering	4	2	2		3
				WRIE3183	GIS and Remote	5	2	0		3
				WRIE3184	Water Resources	4	2	2		3
				WRIE3185	Integrated River Basin	4	2	0		3
				WRIE3186	Legal and Administrative	3	2	0		3
19	WRIE5191	Internship & excursion	30	WRIE5191	Holistic		0	0		0
				WRIE5192	Internship	Pass/Fail	0	0	40	1
				WRIE5193	field trip	0		0		0
20	WRIE5201	Project Work	23	WRIE5201	Entrepreneurship for Engineers	3	2	0		3
				WRIE5202	AutoCAD Application in WRIE	5	1	0		4
				WRIE5203	Software Application in	5	1	0	4	4
				WRIE5204	Water Resources Engineering Project Work	10	0	3	0	14
21	CEng4211	Construction Management	11	CEng4211	Contract Specification and Quantity Surveying	3	2	1	0	2
				CEng4213	Engineering Economics	4	2	2	0	3