Ministry of Education

Test Blueprint for National Exit Examination to be held in 2015 E.C

Band: 2

Program: - Bachelor of Science (B.Sc.) in Biology

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Addis Ababa

Ethiopia

Introduction

The science of biology deals with the systematized acquisition of knowledge on living things and their environments in its basic aspects and the use of such knowledge to benefit mankind in its applied aspects. Biological issues are at the heart of the daily life and survival of humans irrespective of differences in culture, geographical location, wealth and levels of advancement. Biological principles are practiced ranging from primitive societies that use crude ways of getting food and other survival requirements from the immediate environment through hunting and gathering to the most advanced societies that use cutting edge technologies to solve problems that challenge the survival and wellbeing of mankind. Research in climate change, biofuel production, and rapid propagation of crops, gene therapy and cloning are examples of the latter category.

The relevance and importance of biological teaching and research to Ethiopia is thus apparent. As a developing nation aspiring to achieve overall advancement, the country has the option to combine both low and high level knowledge in biology to benefit its society particularly in the areas of food security, health, environmental protection and climate change. The country promotes the science of biology through advanced level university study and research. Accordingly, the newly revised Harmonized Modular Curriculum of Biology for the Bachelor Degree Program which is readjusted to four years is in line with the vision of the country.

As one of the tools to enhance the quality of education at higher institutions, administration of **exit exam** to assess the competence of the graduate is very important. Exit exam is an exam which a student is required to pass in order to complete a course of study. The primary purpose of the exit exams is to assess students' educational achievement in the courses in their major area of program study. It is designed to assess the basic knowledge, skills and attitude of the graduates. The exam is also supposed to measures the learning outcomes of the program as a whole not the individual courses.

Moreover, one way to improve student learning in a way it links with the labour market and economic growth is the introduction of exit exams throughout higher education institutions. In this case, the redesigning of the assessment based on key learning competencies requires the

introduction of nationwide quality indicators for placement and exit tests administered in the Ethiopian Higher Education system. It is recommended in the Education Roadmap that following such excellent practice is important to institutionalize exit exams for all first-degree graduates and put as a requirement accreditation of graduate programs. Accordingly, the Ministry of Education plans to administer exit examinations in 2015 E.C to some selected undergraduate programs in order to improve the quality of higher education. One of the programs selected for this purpose is the BSc Degree Program in Biology.

For the implementation of exit exam, preparation of blueprint that guides item development is essential. This blueprint specifically prepared to develop exit exam item for Bachelor of Science (B.Sc.) in Biology which describes the crucial elements of the exam, including the content to be covered, the amount of emphasis allocated to each content area, and other principal features. It offers a practical guideline for the item writers to develop a standard exit exam. It encompasses the steps that include identifying the vital knowledge, attitude and skill domains (i.e., competencies); delineating the specific assessment objectives; determining the method of assessment to address those objectives; and establishing the amount of emphasis to allocate to each knowledge or skill domain in line with the harmonized curriculum for Bachelor of Science (B.Sc.) in Biology. The table below indicates the steps and the detailed procedures.

Significance of Blueprint Preparation

This blueprint shall have the following significance in the development national wide exit exam for BSc Degree in Biology.

- It indicates the number and/or proportion and type of exam items that are to be developed to measure the assessment's content knowledge, skills and attitudes.
- It provides a guide for item writers as to the exit exam expectations/objectives for which items are to be developed, as well as their levels of cognitive processing (difficulty levels).
- It guides to assess students' educational achievement in major areas of Biology through exams;
- Facilitating the efforts of students to revise the core learning outcomes of the courses covered by the exit examination;

- **Expected profile of the Graduates**
  - ❖ Up on completing the undergraduate study program in Biology, graduate is supposed to acquire the following knowledge, skills and attitudes.

- **General objective**
  - ❖ The overall objective of the program is to train students of high academic caliber at Bachelor of Science level who can take up position in various related disciplines such as teaching, agriculture, health, environmental conservation, industries, research centers, etc
- **Specific objectives**

The specific objectives of the program are to:

- o Enable students to acquire practical and technical skills required for utilizing biological tools.
- o Produce responsible graduates that are committed to their profession.
- o Graduates can design and apply the principles of biology to identify and solve societal problems related to environment, agriculture, health, industry and teaching.
- o Produce graduates for teaching biology in high schools and higher learning institutions of the country.
- o Graduates can design the foundations for a tradition of research oriented and practical system of biology.
- o Graduates capable to analyze and interpret biological data, and present scientific reports in the form of articles, posters or oral presentations.

- **Themes and list of courses**

Table 1: Courses/Focus Areas Categorized into Themes

No	Theme	Title of the Course/Focus Areas
1	Cell Biology and Genetics	Cell Biology
		Genetics
2	Botanical and Zoological Sciences	Seed Plants
		Plant Anatomy and Physiology
		Vertebrate Zoology
		Mammalian Anatomy & Physiology
		Applied Entomology
		Fisheries and Aquaculture
3	Microbiology and Biomedical Science	General Microbiology
		Mycology
		Parasitology
4	Ecological and Environmental Biology	Principles of Ecology
		Conservation and Management of Natural Resources
5	Lab and Field Techniques and Scientific Writing	Biological Laboratory & Field Techniques
		Research Methods and Report Writing in Science

- **Table 2. Total credit hour of the selected courses**

No	Title of the course/focus areas	Cr Hr.
1	Cell Biology	3
2	Genetics	3
3	Seed Plants	3
4	Plant Anatomy and Physiology	4
5	Vertebrate Zoology	4
6	Mammalian Anatomy & Physiology	4
7	Applied Entomology	3
8	Fisheries and Aquaculture	2
9	General Microbiology	3
10	Mycology	2
11	Parasitology	3
12	Principles of Ecology	3
13	Conservation and Management of Natural Resources	2
14	Biological Laboratory & Field Techniques	2
15	Research Methods and Report Writing in	2

	Science	
Total Credit Hour = 43		

- **Share of the Themes/Courses/Items in Percentage (%)**

S.N.	Themes	Shares of the themes	Names of the Course	Cr. Hours	Shares of course	Shares of the Competencies		
						Know	Skill	Attitude
1	Cell Biology and Genetics	14%	Cell Biology	3	7%			
			Genetics	3	7%			
2	Botanical and Zoological Sciences	46%	Seed Plants	3	7%			
			Plant Anatomy and Physiology	4	9%			
			Vertebrate Zoology	4	9%			
			Mammalian Anatomy & Physiology	4	9%			
			Applied Entomology	3	7%			
			Fisheries and Aquaculture	2	5%			
3	Microbiology and Biomedical Science	19%	General Microbiology	3	7%			
			Mycology	2	5%			
			Parasitology	3	7%			
4	Ecological and Environmental Biology	12%	Principles ofEcology	3	7%			
			Conservationand ManagementofNatural Resources	2	5%			
5	Lab and Field Techniques and Scientific Writing	9%	Biological Laboratory & Field Techniques	2	5%			
			ResearchMethodsandReport Writing inScience	2	5%			

Table 3. The blueprint (specification) in terms of the three domains (Cognitive, Affective and Psychomotor).

Themes	Share of the themes	Name of Courses	Credit hour	Share of the themes in %	General objective	Specific objectives	Cognitive	Affective	Psychomotor
Cell Biology and Genetics	14%	Cell Biology	3	7%	Understand basic knowledge concerning cellular biology	Discuss the cell theory	X		
						List methods of studying cells	X		
						Describe the structure of cellular organelles and their functions	X		
						Discuss membrane transport mechanisms		X	
						Characterize enzymes and their catalytic activities		X	
		Genetics	3	7%	To build knowledge on the fundamentals of genetics, heredity, or inheritance.	Analyze Mendelian principles and laws of heredity	X		
						Discuss the existence of genes in allelic forms		X	
						Test goodness of fit between observed and expected genetical data	X		
						Explain the cytological basis of Mendelian laws of inheritance and how various Mendelian ratios are obtained	X		
						Differentiate between dominant and epistatic gene interactions	X		
						Describe chromosomal basis of sex determination	X		
						Compare and contrast transmission and expression of autosomal and sex linked traits	X		
						Explain how the DNA stores genetic information and passes it to RNA and protein	X		
						Discuss the effect of mutation on protein structure and function		X	
						Understand genetics at population level	X		
						Discuss applications of modem genetics in various fields		X	
Botanical and Zoological Sciences	46%	Seed plants	3	7%	Identify and characterize seed plants based on the morphological, physiological and adaptation features	Differentiate Gymnosperms and angiosperm	X		
						Discuss the morphology of higher vascular plants		X	
						Differentiate monocots and dicotyledons	X		
						Discuss diversity, adaptation, phylogenetic relationship and economic importance of higher plants (Gymnosperms and Angiosperms		X	
		Plant Anatomy	4	9%	Comprehend the	Differentiate the three tissue systems in plant	X		

		and Physiology			concepts of anatomy, morphology, physiology and adaptation of plants to different environmental conditions.	Describe the anatomy of roots, leaves and stems	X		
						Explain in the anatomical difference in angiosperms and gymnosperms	X		
						Explain biophysical and physicochemical relationship in plant physiology	X		
						Explain plant water relations	X		
						Describe plant nutrients, their uptake mechanisms, their roles and deficiency symptoms.	X		
						Discuss plant growth and development.		X	
						List factors affecting plant growth and development	X		
						Explain the plant physiological basics of photosynthesis, respiration, nutrition and translocation of substances.	X		
						Identify nutrient deficiency symptoms in plants and propose solutions	X		
						Describe the mechanisms used by plants to adapt to different environments	X		
						Discuss the defense mechanisms used by plants		X	
		Vertebrate Zoology	4	9%	Identify organisms based on the morphological, physiological and behavioral characteristics	Identify the major invertebrate phyla and describe them	X		
						Describe the characteristic morphological and physiological features of the various invertebrate groups	X		
						Explain the characteristics including challenges and constraints of the habitats where the various groups of invertebrates live	X		
						Discuss the medical, economic and environmental importance of invertebrates		X	
						Relate the evolutionary relationship of invertebrates	X		
		Mammalian Anatomy & Physiology	4	9%	Comprehend the concepts of anatomy, morphology, physiology and adaptation of animals to different environmental conditions.	Describe scopes of mammalian anatomy and physiology	X		
						Explain structure and functions of the integument	X		
						Discuss skeletal, muscular and tooth anatomy		X	
						Explain the various physiological systems of mammals	X		
						Relate sense organs and their functional processes	X		
						Discuss homeostasis		X	
		Applied Entomology	3	7%	To make students aware of the applications of entomology to understand the economic losses and benefits of insects.	Differentiate insects and related arthropods	X		
						Discuss insect structure, physiology, biochemistry, development, ecology and evolution		X	
						Identify the beneficial, harmful and social insects collect insects using different methods	X		
		Fisheries and Aquaculture	2	5%		Discuss the diversity, abundance and distribution of most commercially important fish		X	

						Discuss the status and potential of Ethiopian fisher resources		X	
						Participate in establishment and maintenance of aquacultures		X	
						Devise sound fisheries management strategies	X		
Microbiology and Biomedical Science	19%	General Microbiology	3	7%	To impart knowledge of the basic principles of bacteriology, virology, mycology, immunology and parasitology including the nature of pathogenic microorganisms, pathogenesis, laboratory diagnosis, transmission, prevention and control of diseases common in the country.	Describe the historical development, major concepts, principles and applications of microbiology.	X		
						Identify the major groups of microorganisms; their morphology, biology, importance and ecology.	X		
						Explain the main concepts and importance of microbial growth and metabolism.	X		
						Describe the diversity, evolution and ecology of micro-organisms	X		
						Develop practical knowledge of culturing, skill of staining and methods in microbiology discuss the beneficial and harmful aspects of microorganisms in food, agriculture, health and other industries	X		
		Mycology	2	5%	To examine the biology of the true fungi and other groups of organisms traditionally classified with the fungi.	Discuss the ecological importance of fungi.		X	
						Demonstrate an understanding of how fungi impact human life.	X		
						Describe the taxonomy of fungi and how the fungi relate to other organisms.	X		
						Discuss the characteristics of the major groups of fungi.		X	
						Explain how fungi grow and reproduce.	X		
						Isolate different fungal groups.	X		
						Describe the major fungal association with other organisms.	X		
						Discuss the economic and medical importance of fungi.		X	
		Parasitology	3	7%	To provide students with knowledge concerning biological, epidemiological and ecological aspects of parasites causing diseases to humans and other animals.	Define parasitism	X		
						understand the scope and relevance of parasitism in terms of human and animal diseases	X		
						Identify the morphological features of common protozoan and helminthic parasites of man and his domesticated animals	X		
						understand the life cycle, pathology and diagnostic measures of parasitic infections	X		
						Discuss factors affecting host parasite relationship (parasite adaption in the hosts' environment versus host's immune reactions).		X	
						Analyze epidemiological survey data of parasitic infections in a given village (area).	X		
						Describe the epidemiology of protozoan and helminthic parasites and their importance as public health and economic problems in Ethiopia.	X		
Ecological and Environmental Biology	12%	Principles of Ecology	3	7%	To understand the distribution of biotic and abiotic factors of living	Describe ecological terminologies	X		
						Describe environmental factors	X		
						Explain communities and their structural characteristics	X		
						Differentiate ecosystems and their functional dynamics (nutrient	X		

					things in the environment.	cycles, productivity, trophic levels)			
						List Ethiopian Ecosystems.	X		
		Conservation and Management of Natural Resources	2	5%	To protect and preserve the flora and fauna to main the balance in the ecosystem.	Describe historical development of Conservation Biology	X		
						Discuss basic concepts of conservation Biology		X	
						List types of natural resources	X		
						Discuss the importance of Biodiversity		X	
						Enumerate threats to biodiversity and natural resources	X		
						List different methods involved in conservation and management of natural resources	X		
						Discuss what roles governments and other institutions in conservation endeavors play		X	
Lab and Field Techniques and Scientific Writing	9%	Biological Laboratory & Field Techniques	2	5%	To Apply traditional and modern biological techniques to identify potential pathogens and solve aspects of scientific problems.	Recognize biological safety rules and handle biological tools safely.	X		
						Develop skills and techniques of using basic biological equipment, chemicals, reagents and media in the laboratory	X		
						Use the microscope properly	X		
						Use the microscope properly	X		
						Prepare wet-mount temporary slides for microscopic observations;	X		
						Conduct simple biological experiments;	X		
						Describe mechanisms of material transportation across biological membranes;	X		
						Collect and preserve plant and animal specimens from terrestrial and aquatic ecosystems;	X		
						Identify materials and equipment for field studies of plants and animals;	X		
						Plan and carry out scientific field trips and report writing;	X		
						Conduct field survey of plants and animals using different techniques (quadrants, gear, net, capture-mark-release, visual observation, etc).	X		
		Research Methods and Report Writing in Science	2	5%	Carry out basic practical researches and their presentation	Identify a research problem, and develop a hypothesis	X		
						Design an experiment and write a research proposal	X		
						Describe the hierarchy of the scientific literature and the methods used in presenting scientific results in dissertations and scientific journals.	X		
						prepare a review paper	X		
						Present research results in oral and poster form to professional and non-professional audience.	X		
						Describe some basic rules and regulations of research ethics	X		