



Ministry of Education

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

Brand: I

Program: Bachelor of Science Degree in Textile Engineering

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1 Introduction

The Ministry of Education of Ethiopia has announced the implementation of an exit exam for all undergraduate program students (public and private), beginning with the 2022/2023 academic year, to improve the quality of graduates produced by higher learning institutions. The exit exam is aimed at checking whether students have acquired the required knowledge, skills and attitudes or not. Implementing this requires determining competency areas for a specific program, which is already completed. Based on the competency areas prepared, it needs to plan the construction of tests.

Creating an exam blueprint will help to plan which questions to include in an exam and ensure that it adequately assesses the learning objectives of the course. An exam blueprint defines the knowledge, skills and attitude that one wants to assess and will enable one to build purpose-driven, successful assessments. Planning a test is the first and vital step in the construction of an achievement test. An achievement test demands very systematic and careful planning, as a fact that good planning is a symbol of success. Tests are the tools that provide scores that measure the level of student learning and study program learning outcomes. To achieve the valid and reliable measurement of student learning and program learning outcomes, the development of valid and reliable tests is mandatory. A test should be able to measure student performance in all dimensions of knowledge, skill and attitude. The carefully planned test construction contributes to improving the overall quality of the test in terms of test content validity, difficulty level, discrimination power and test reliability. Test preparation is not an easy task; it requires careful planning and guideline to make the task simple. Test construction needs the preparation of a test blueprint. A test blueprint is defined as a complete plan that explains how to develop a test. The term refers to a map or specification of assessment to ensure that all aspects of the curriculum and educational domains are covered by the assessment programs over a specified period. It helps curriculum developers/test constructors to match various competencies with the course content and the appropriate modality of assessment.

Generally, a test blueprint will help to ensure tests: 1) Appropriately assess the achievement of instructional objectives of the course; 2) Appropriately reflect key course goals, objectives and

the material learned or covered during the instruction period; and 3) Include the appropriate item formats along with the knowledge and skills being assessed.

Test blueprint document used to help the test developers or content specialists in their process of valid and reliable test construction. The major points considered in the process of preparing this test blueprint guideline were the core competencies that have been already identified for the themes of courses, the course contents, course credit hours, and the learning outcomes with their corresponding levels of achievement by learning domains. In line with these, the number of test items that should adequately assess the performance of students in all the content topics will be determined through discussion with the content specialists who construct the blueprint and test for their corresponding study program.

Therefore, the main purpose of this manual is to give direction to test developers or writers for the textile engineering program.

2 Objective and Significance of blueprint

Test blueprint preparation is generally used to assist the preparation of a test that is representative, broadly sampled, and consists of the complete knowledge domain expected of Ethiopian higher education students on completion of their study program.

The specific objectives of the test blueprint are to:

- Facilitate the construction of representative and balanced test items for the selected courses under the competencies identified.
- Guide test developers or writers to write or set appropriate test items.

Test blueprints will help to ensure the following significance:

- Appropriately assess the instructional objectives of the course
- Appropriately reflect key course goals and objectives – the material to be learned
- Include the appropriate item formats for the skills being assessed
- Demonstrate to students the topics to value, and serve as a study guide for them
- Facilitate learning by providing a framework or mental schema for students
- Ensure consistent coverage of exam content from year to year
- Communicate course expectations to stakeholders

3 Expected Profiles of Textile engineering Graduates

A graduate's profile is the general description of the desirable qualities of graduates in real-world work. Graduates' profile helps to determine the students' conceptual knowledge, skills, and attitude that they possess. A graduate profile can be advanced through experience in the real world. Textile Engineering is a profession that deals with the application of scientific and engineering principles to the design and control of all aspects of fibers, yarns, woven and knitted materials, technical textiles, nonwovens, products, and machinery. The competency of graduates will be measured by the national exit examination after completion of textile engineering courses with a great emphasis on students' knowledge, skill, and attitude. The details of the expected graduate profile are presented here below by categorizing knowledge, skills, and attitudes.

Table 1: Expected graduate profiles to be achieved

Areas of Competency	Expected graduate profiles to be achieved
Knowledge	Graduates will be able to: ● Understand the fundamentals and concepts in the core Textile Engineering areas that include Fibre Science, Spinning, Fabric formation, Technical Textiles, Non-woven, Textile Testing and Quality management ● Identify and evaluate materials, products, and production systems of the fibre-textile-clothing chain ● Design range of products and operations from raw material selection to final finishing and packaging including quality control and management at all the stages of production ● Solve complex problems in the field of Textile Engineering using the knowledge of textile material properties, inspection and testing, selection, processing, characterization, and applications. ● Develop new processes, textile materials, and products using basic knowledge of mathematics, physics, chemistry, and engineering concepts and models. ● Develop machine and product specifications, design a layout for a textile plant, manage a project, and analyse textile costings.

	● Develop research to generate innovation and inputs, articles, and manufacturing processes of the fibre-textile-apparel chain.
Skills	● Design, implement, operate, and supervise production systems of the fibre-textile-clothing chain for decision-making regarding product development, quality, production, and resource management ● Transform fibers into yarns; produce fabrics and nonwovens; modify the physical, chemical, and mechanical properties of textile structures: such as coloring, printing, and softening. ● Analyze and design a system, component, or process to meet desired needs of industries and society within realistic constraints ● Organize laboratories, and operate different experimental instruments and machines relevant to Textile Engineering. ● Perform product quality testing and interpret experimental data to make correct decisions. ● Hands-on skills in the safe operation and maintenance of textile processing equipment and machinery ● Communication skills and team spirit enables to work with various professionals including businessmen ● Ability in “scientific writing” for technical reports in management, projects, and research ● Can apply basic computer skills and software applications in textile engineering research and analysis.
Attitudes	● Recognize the ethical and professional responsibilities of Textile Engineers in global, economic, environmental, and societal contexts for sustainable materials utilization ● Understand and adhere to the highest standards of the engineering profession and ethical behavior ● Recognition of the need for, and an ability to engage in life-long learning

	● Recognize and appreciate social, political, economic, and environmental impacts of Textile Engineering projects on scales that range from local to global ● Communicate effectively and function within a team to collaborate and create an inclusive environment with the scientific community and stakeholders ● Encourage and promote social and sustainable responsibility in their professional practice. ● Ready themselves towards self-employment (entrepreneurs)
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4 Objectives of the Program

4.1 General Objective

The main objectives of the textile engineering program at the B.Sc. level are:

- To enable graduates to be creative, adaptable, and problem-solving in the rapidly changing environment that exists around the globe.
- To apply existing knowledge in new ways thereby creating new systems and opportunities as well as adapting existing technology to local production conditions.
- To initiate, develop and sustain research activities that are critical for the conditioning of advancement of the Ethiopian textile sector.

4.2 Specific objectives

After completing those courses presented on the mentioned themes, graduating students will be able to:

- Know the fundamental concepts of polymers and polymer manufacturing principles
- Understand polymer processing methods, analyze the structure and testing of polymer properties, and characterize by different methods
- Know the basic classification and end-use applications of different textile fibers
- Understand the principles of manufacturing processes of textile fibers
- Understand the chemistry of textile fibers, and know the structure and the properties of textile fibers
- Know the basic raw materials, working principles and processes of spinning

- Understand the practical aspects of opening, cleaning, mixing, and blending fibers and the method of waste collection
- Know to master the machinery and processing in the roving Frames, ring frames and rotor spinning
- Know the different preparatory processes and features of machines required for weaving
- Understand the knowledge and advantages of using the shuttleless looms
- Know various shuttleless machine operations and their working principles
- Demonstrate the mechanisms and principles of different weaving machine parts
- Know the differences between the weaving and knitting processes
- Understand the structure and machine principle of knitting technology
- Recognize the basic concepts involved in Weft and Warp knitting
- Exposure to the latest developments in knitted fabric production
- Understand the principles and applications of Design in the context of Fabric Structure and Design
- Distinguish the woven fabric structures and concepts of production of fabrics with these structures.
- Know the characteristics and end uses of the fabric with these structures.
- Exposure to various color combinations and fabric designs.
- Know the technology of nonwoven fabrics, manufacturing processes in terms of web formation, bonding processes, finishing processes, end uses and
- Understand the principle of nonwoven fabric manufacturing machinery
- Know the fundamental concepts in pretreatment chemical processing of textile materials
- Understand the different preparatory finishing operations
- Understand the principles of some of the textile finishing operations
- Understand the types of machinery, mechanism and processing methods used in the preparatory of textile materials
- Know the fundamental concepts in coloration chemical technology of textile materials
- Know different dyes and dyeing methods used for coloration of textile materials
- Understand the different printing styles and printing methods
- Know the different dyeing and printing equipment
- Know the Basic Theory of Color Science

- Understand the Principles of Color Measurement and Communication
- Understand Color Recipe Prediction and Color Measurement Instruments
- Know the fundamental concepts and principles involved in the mechanical and chemical finishing of textile materials
- Know general quality aspects and sampling techniques of fibres, yarns, and fabrics
- Understand the working principle of instruments and the method of test result analysis
- Understand the basic concepts of quality management systems
- Describe the criteria of standard quality requirements of textile products based on ISO 9000 QMS and ASTM
- Describe the process control techniques in textile manufacturing
- Understand and apply statistical process control-SPC tools in textile industries
- Identify the defects of the textile product and devise the controlling mechanisms
- Understand the quality assurance and reliability of textile products

5 Themes and Courses to be included in the exit exam

The courses to be considered for the exit examination have been selected in view of assessing the competencies and learning outcomes that graduates are expected to attain. Therefore, a total of 13 major mandatory courses are selected for exit exams under a specified thematic area. The practical part of each course is offered separately but to minimize the number of courses, the practical assessment shall be included with the main courses.

Table 2: List of courses in the Textile Engineering program to be included in the exit exam

SN	List of themes	List of courses in the Textile Engineering program	ECTS	Cr. Hr
1	Fiber Science and Technology	- Polymer Science and Textile Fibres	5	4
2	Spinning Technology	- Yarn Manufacturing I	5	4
		- Yarn Manufacturing II	5	4

3	Fabric Manufacturing Technology	- Woven Fabric Manufacturing I	5	4
		- Woven Fabric Manufacturing II	5	4
		- Fabric Structure and Design	5	4
		- Knitting Technology I	5	3
		- Knitting Technology II	5	3
		- Non-woven Technology	2	2
4	Textile Wet Processing	- Textile Pretreatment and Finishing	4	3
		- Textile coloration and Analysis	5	4
5	Textile Testing and Quality Management	- Textile Materials Testing	6	5
		- Quality Management and Control	3	2
Total	5 thematic areas	13 courses	60	46

6 Learning outcomes in terms of the three domains (Cognitive, Affective and Psychomotor)

Table 3: Learning outcomes, level, and proportion of cognitive, affective, and psychometric measures

Theme	Course Name	General objective	Learning outcomes	Cognitive						Affective	Psychometric	Total items
				Remember	Understand	Apply	Analyse	Evaluate	Create			
Fiber Science and Technology	Polymer Science and Textile Fibres	To know and analyse the properties, processing methods and end-use application of polymers and fibres	Know the fundamental concepts of polymers and polymer manufacturing principles		1							1
			Understand polymer processing methods, analyze the structure and testing of polymer properties, and characterize by different methods		1		1	1				3
			Know the basic classification and end-use applications of different textile fibers			1			1			2
			Evaluate the principles of manufacturing processes of textile fibers					1				1
			Apply and analyze the chemistry of textile fibers, and know the structure and the properties of textile fibers			1	1					2

				--	2	2	2	2	1	--	--	9
Spinning Technology	Yarn Manufacturing I	To know and evaluate the properties and processing methods fibres up to sliver formation	Know the basic raw materials, working principles and processes of yarn manufacturing					1	1	1	1	4
			Understand the practical aspects of opening, cleaning, mixing, and blending fibers and the method of waste collection		1					1	1	4
			Demonstrate the principles of the preparatory process of the short- and long-staple spinning process with ginning process of cotton.		1							
				--	2	--	--	1	1	2	2	8
	Yarn Manufacturing II	To acquire the way of different yarn production systems and mechanisms of machinery	Know the basic raw materials, working principles and processes of yarn spinning				1			1	1	3
			Know to master the machinery and processing in the roving Frames, ring frames and rotor spinning		1					1	1	3
			Sketching the gearing diagram and calculating different parameters such as drafts and speed in roving, ring, and rotor spinning					1		1		2
			Perform production calculations and process							1		1

			parameters in post-spinning processes									
				--	1	--	1	1	--	4	2	9
Fabric Manufacturing Technology	Woven Fabric Manufacturing I	Know and recognize the purpose of weaving	Know the different preparatory processes and features of machines required for weaving		1		1			1		5
		preparatory machinery and their working mechanisms	Understand basic weaving preparatory processes such as winding, warping, sizing, drawing-in & tying-in, shuttle weaving, automatic shuttle loom		1				1			4
			Demonstrate the basic Mechanisms of the process, Loom Parts and their function, Loom Classification, Loom drive and Control		1				1	1	1	
				--	3	--	1	--	2	2	1	9
	Woven Fabric Manufacturing II	Understand the advantages of the modern shuttleless loom compared to the oldest shuttle loom. Demonstrate the	Understand the knowledge and advantages of using the shuttleless loom		1		1	1				3
			Know various shuttleless machine operations and their working principles				1			1		3
			Demonstrate the mechanisms and principles of different weaving machine parts					1		1	1	3

		type, production method and mechanisms of different weaving machinery.	Perform production calculations and set process parameters in post spinning process								1	
				--	1	--	2	3	--	2	1	9
	Fabric Structure and Design	Know the way of woven fabric structure design related to end-use application	Understand the principles and applications of Design in the context of Fabric structure and Design		1							1
			Distinguish and analyze the woven fabric structures and concepts of production of fabrics with these structures.		1		1	1				3
			Know the characteristics and end uses of the fabric with these structures.		1				1	1		3
			Create various color combinations and fabric designs.							1	1	2
				--	3	--	1	1	1	2	1	9
	Knitting Technology I	Know the production method and properties of weft-knitted fabrics related to different parameters	Understand the basic and advanced knowledge in the field of knitting technology.		1							1
			Acquire the production and processes for the transformation of different sorts of yarns into knitted structures.								1	1
			Apply and analyze various parameters in the production			1		1				2

			of knitted fabrics.									
			Construct a new market-acceptable knitted product using different scientific methods.							1	1	2
				--	1	1	--	1	--	1	2	6
	Knitting Technology II	Know the production method and properties of warp-knitted fabrics related to different parameters	Know the basic relationships between weft and warp technologies		1							1
			Understand elements of warp knitting machinery.		1							1
			Perform design of weft and warp knit structures.			1					1	2
			Familiarize the process of warp knitting						1		1	2
			Know and analyze the motion transmission, material passage and fabric production in warp knitting.				1					1
				--	2	1	1	--	1	--	2	7
	Non-woven Technology	Demonstrate the raw material type, production method and end-use application of nonwoven fabrics	Know the technology of nonwoven fabrics, manufacturing processes in terms of web formation, bonding processes, finishing processes, end uses and		1	1						2
Understand the principle of nonwoven fabric manufacturing machinery						1		1			2	
				--	1	1	1	--	1	--	--	4

Textile Wet Processing	Textile Pre-treatment and Finishing	Know the types, machinery and principles of textile pre-treatment and finishing process	Know the fundamental concepts in pretreatment chemical processing of textile materials				1					1
			Understand the different methods of finishing operations		1							1
			know the principles of some of the textile finishing operations			1	1					2
			Understand the types of machinery, mechanisms and processing methods used in the pretreatment of textile materials							1	1	2
				--	1	1	2	--	--	1	1	6
	Textile coloration and Analysis	Know the types and the way how to apply Textile coloration and analysis the colour effect on the fabric	Know the fundamental concepts in coloration chemical technology of textile materials		1							1
			Know different dyes and dyeing methods used for coloration of textile materials							1		1
			Apply the different printing styles and printing methods			1					1	2
			Know the different dyeing and printing equipment					1				1
			Know the Basic Theory of Color Science		1							1

			Know the Principles of Color Measurement and Communication							1		1
			Perform Color Recipe Prediction and Color Measurement Instruments						1		1	2
				--	2	1	--	1	1	2	2	9
Textile Testing and Quality Management	Textile Materials Testing	Identify and know the types of textile testing equipment related to endues applications and its analysis of the result	Understand general quality aspects of fibres and yarns		1							1
			Sample preparation and knowing the properties of fibers, intermediate products and yarns								1	1
			Apply the ways to check the quality of intermediate products and yarn			1						1
			Know the working principle of testing instruments					1				1
			Understand the method of test analysis and interpretation of the results								1	1
			Know the general quality aspects of grey and finished fabrics		1							1
			Know the sampling techniques of fabrics							1		1
			Understand the properties of grey and finished fabrics				1					1
			Know the ways to check the quality of fabric in wet processing conditions			1						1

			Know the working principle of testing instruments of fabric and working on them								1	1
			Understand the method of test analysis and interpretation of the results concerning fabric quality							1		1
				--	2	2	3	1	--	2	3	11
	Quality Management and Control	Know the different techniques of process and product quality assessments	Understand the basic concepts of the quality management system		1							1
			Describe the criteria of standard quality requirements of textile products based on ISO 9000 QMS and ASTM							1		1
		Know how to check the quality of textile fabrics based on international standards	Apply statistical process control-SPC tools in textile industries								1	1
			Identify the defects of the textile product and devise the controlling mechanisms related to quality assurance and reliability of textile products							1		1
				--	1	--	--	--	--	2	1	4

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

Table 4: Test blueprint share of the themes and courses (Total test items = 100)

Themes	Course Name	Credit Hours	Weight of course or proportion	No of test items from each course	Cognitive						Affective	Psychometric	Total
					Remember	Understand	Apply	Analyse	Evaluate	Create			
Theme 1 Share = 9%	Polymer Science and Textile Fibres	4	4/4=1.0	1*9=9	--	2	2	2	2	1	--	--	9
	Theme 1 total	4			--	2	2	2	2	1	--	--	9
Theme 2 Share = 17%	Yarn Manufacturing, I	4	4/8=0.5	0.5*17=9	--	1	--	--	1	2	2	2	8
	Yarn Manufacturing II	4	4/8=0.5	0.5*17=9	--	1	--	1	1	2	2	2	9
	Theme 2 total	8			--	2	--	1	2	4	4	4	17
Theme 3 Share = 44%	Woven Fabric Manufacturing I	4	4/20=0.2	0.2*44=9	--	1	1	1	1	1	2	2	9
	Woven Fabric Manufacturing II	4	4/20=0.2	0.2*44=9	--	1	--	2	3	--	2	1	9
	Fabric Structure and Design	4	4/20=0.2	0.2*44=9	--	3	--	1	1	1	2	1	9
	Knitting Technology, I	3	3/20=0.15	0.15*44=6	--	1	1	--	1	--	1	2	6
	Knitting Technology II	3	3/20=0.15	0.15*44=7	--	2	1	1	--	1	--	2	7
	Non-woven Technology	2	2/20=0.1	0.1*44=4	--	1	1	1	--	1	--	--	4
	Theme 3 total	20				9	4	6	6	4	7	8	44
Theme 4 Share = 15%	Textile Pre-treatment and Finishing	3	3/7=0.4	0.4*15=6	--	1	1	2	--	--	1	1	6
	Textile coloration and Analysis	4	4/7=0.6	0.6*15=9	--	2	1	--	1	1	2	2	9
	Theme 4 total	7			--	3	2	2	1	1	3	3	15
Theme 5 Share = 15%	Textile Materials Testing	5	5/7=0.7	0.7*15=11	--	2	2	3	1	--	1	2	11
	Quality Management and Control	2	2/7=0.3	0.3*15=4	--	1	--	--	--	--	2	1	4
	Theme 5 total	7			--	3	2	3	1	--	3	3	15
Total for the program		46			--	19	10	14	12	10	17	18	100

8 Conclusion

Exit examination can have a vital role in producing knowledgeable, skilful, and attitudinally matured graduates. It also helps in improving academic programs' quality and effectiveness. Furthermore, it can create a platform for cooperation among academic programs at different universities to work jointly to improve the program's quality. In view of this, previously a guideline was prepared to comprise expected graduate profiles, competencies, core courses, and learning outcomes with five thematic areas and 13 core courses for the exit exam in Textile Engineering (B.Sc.).

This document is a test blueprint which is the second document prepared to assist in the setting of the exit examinations for the Textile Engineering program. Preparing a test blueprint is necessary to prepare fairly distributed Test items based on the above criteria. The major points considered in the process of preparing this test blueprint guideline were the core competencies that have been already identified for the themes of courses, the course contents, course credit hours, and the learning outcomes with their corresponding levels of achievement by learning domains.

In this document, the identified themes and list of courses under it, the share of the themes in percentage, the weight of each course, and the number of test items from each course are set based on the credit hour and learning outcomes specified in the curriculum. For each specific objective, the required number of test items distributed across the learning outcomes is shown. Therefore, test setters can use this document as a reference to prepare test items based on the distributed learning outcomes in the test blueprint table.

9 References

- I. BSc in Textile Engineering curriculums of Bahir Dar University, Ethiopian Institute of Textile and Fashion Technology (EiTEX), Wollo University, and Hawassa University