

THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY



BASIC APPLIED MATHEMATICS SYLLABUS FOR ADVANCED SECONDARY EDUCATION
FORM V-VI
2023

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Abbreviations and Acronyms

AI	Artificial Intelligence
TIE	Tanzania Institute of Education
ICT	Information and Communication Technology

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1.0 Introduction

Basic Applied Mathematics for Advanced Secondary Education is a compulsory subject for students who will opt to study Natural Sciences and Business studies combinations and whose Mathematics is not one of the core subjects in their combination. It also excludes students who have studied and passed Additional Mathematics at Ordinary Secondary Education Examination. The purpose of learning Basic Applied Mathematics is to deepen students' ability in applying mathematical skills in different contexts. Furthermore, the subject aims to enable students to apply mathematical knowledge and skills to solve problems in different contexts.

This Syllabus is designed to guide the teaching and learning of Basic Applied Mathematics at Advanced Secondary Education, Form V-VI, in the United Republic of Tanzania. The syllabus interprets the competences indicated in the 2023 Advanced Secondary Education Curriculum. It also provides teaching and learning opportunities that guide teachers to apply different methods and strategies to promote students' mathematical literacy and develop 21st century skills which include communication, collaboration, critical thinking, creativity and problem solving.

2.0 Main Objectives of Education in Tanzania

The main objectives of education in Tanzania are to enable every Tanzanian to:

- (a) Develop and improve his or her personality so that he or she values himself or herself and develops self-confidence;
- (b) Respect the culture, traditions and customs of Tanzania; cultural differences; dignity; human rights; attitudes and inclusive actions;
- (c) Apply science and technology, creativity, critical thinking, innovation, cooperation, communication and positive attitudes for his or her development and the sustainable development of the nation and the world at large;
- (d) Understand and protect national values, including dignity, patriotism, integrity, unity, transparency, honesty, accountability and the national language;
- (e) Develop life and work-related skills to increase efficiency in everyday life;
- (f) Develop a habit of loving and valuing work to increase productivity and efficiency in production and service provision;
- (g) Identify and consider cross-cutting issues, including the health and well-being of the society, gender equality, as well as the management and sustainable conservation of the environment; and

- (h) Develop national and international cooperation, peace and justice in accordance with the Constitution of the United Republic of Tanzania and international conventions.

3.0 Objectives of Advanced Secondary Education

The Objectives of Advanced Secondary Education are to:

- (a) Strengthen, broaden and develop a deeper understanding of the knowledge, skills and attitudes developed at the Ordinary Secondary Education;
- (b) Safeguard customs and traditions, national unity, national virtues, democracy, respect for human and civil rights, duties and responsibilities associated with such rights;
- (c) Develop self-confidence and the ability to learn in various fields, including science and technology as well as theoretical and technical knowledge;
- (d) Improve the use of language in academic communication.
- (e) Strengthen accountability for cross-cutting issues, including health, security, gender equality and sustainable environmental conservation;
- (f) Develop competence and various skills which will enable the student to employ himself or herself, to be employed and to manage his or her life by exploiting his or her environment well; and
- (g) Develop readiness to continue to a college education.

4.0 General Competences for Advanced Secondary Education

The general competences for Advanced Secondary Education are to:

- (a) Apply the knowledge and skills acquired in Ordinary Secondary Education to strengthen and broaden academic understanding;
- (b) Demonstrate an appreciation of citizenship, national virtues, human rights and civil rights;
- (c) Demonstrate confidence in learning various fields, including Science and Technology, theoretical knowledge and vocational education;
- (d) Use language skills in academic communication;

- (e) Apply knowledge of cross-cutting issues to master the surrounding environment.
- (f) Use knowledge and skills to enable a student to employ oneself, be employed as well as manage life and his/her environment; and
- (g) Demonstrate readiness to proceed to the next level of education.

5.0 Main and Specific Competences

The main and specific competences to be developed are presented in Table 1.

Table 1: *Main and Specific Competences for Form V-VI*

Main competences	Specific competences
1.0 Use applied mathematical knowledge and skills	1.1 Use some advanced skills in geometry, trigonometry, and vectors to solve problems in different contexts 1.2 Use functions and calculus to solve problems in different contexts 1.3 Use statistics to solve problems in different contexts
2.0 Use algebra, set theory and logic to solve problems in different contexts	2.1 Use set theory and logic in argumentation and decision making 2.2 Apply knowledge of sequences and series in different contexts 2.3 Apply knowledge of algebra and number theory in different contexts

6.0 Roles of Teachers, Students, and Parents in Teaching and Learning Process

A good relationship between a teacher, student and parent or guardian is fundamental in ensuring successful learning. This section outlines the roles of each participant in facilitating effective teaching and learning of Basic Applied Mathematics

6.1 The teacher

The teacher is expected to:

- (a) Help the student to learn and acquire the intended competencies in Basic Applied Mathematics;
- (b) Use teaching and learning approaches that will allow students with different needs and abilities to:
 - (i) Develop the competencies needed in the 21st century;
 - (ii) Actively participate in the teaching and learning process, keeping in mind the student's needs and abilities;
- (c) Use student centred instructional strategies that make the student a centre of learning which allow them to think, reflect and search for information from various sources;
- (d) Create a friendly teaching and learning environment;
- (e) Prepare and improvise teaching and learning resources;
- (f) Conduct formative assessment regularly by using tools and methods which assess theory and practice;
- (g) Treat all the students equally irrespective of their differences;
- (h) Protect the student while at school;
- (i) Keep track of the student's daily progress;
- (j) Identify individual student's needs and provide the right intervention;
- (k) Involve parents/guardians and the society at large in the student's learning process;
- (l) Integrate cross-cutting issues and ICT in the teaching and learning process;

6.2 The student

The student is expected to:

- (a) Develop the intended competencies by participating actively in various learning activities inside and outside the classroom;
- (b) Participate in the search for knowledge from various sources, including textbooks, reference books and other publications in online libraries.

6.3 The parent

The parent/guardian is expected to:

- (a) Monitor the child academic progress in school;
- (b) Where possible, provide the child with the needed academic support;
- (c) Provide the child with a safe and friendly home environment which is conducive for Learning;
- (d) Keep track of the child progress in behaviour;
- (e) Provide the child with any necessary materials required in the learning process;
- (f) Instil in the child a sense of commitment and positive value towards education and work.

7.0 Teaching and Learning Methods

The teaching and learning methods are instrumental in developing student's competences. This syllabus suggests teaching and learning methods for each activity which includes but not limited to discussions, presentations, field visits, practical work, research, scientific experiments, and project works. However, a teacher is advised to plan and use other appropriate methods based on the environment or context. All the teaching and learning methods should be integrated with the everyday lives of students.

8.0 Teaching and Learning Resources

The process of teaching and learning requires different resources. In that regard, both the teacher and students should work together to collect or improvise alternative resources available in the school and home environment when needed. The teacher and student are expected to constantly seek for information from various sources to effectively facilitate teaching and learning process. The list of approved textbooks and reference books shall be provided by TIE.

9.0 Assessment

Assessment is important in teaching and learning of Basic Applied Mathematics subject. It is divided into formative and summative assessments. Formative assessment informs both the teacher and students on the progress of teaching and learning, and in making

decisions on improving the teaching and learning process. Teachers are, therefore, expected to apply a wide range of formative assessment methods which include but not limited to discussions, presentations, oral questions, experiments, observations, practical and projects.

Summative assessment, on the other hand, will focus on determining student's achievement of learning. Teachers are expected to use a variety of summative assessments including mid-term tests, terminal, mock examinations and projects. The scores obtained from these assessments will be used as Continuous Assessment (CA). Therefore, the continuous assessments shall contribute 30% and the National Form VI Examination shall be 70% of the student's final achievement, as indicated in Table 2.

Table 2: *Contribution of Continuous Assessment and National Examination in the final score*

Assessment Measures	Form V	Form VI
First Term Examination	5%	5%
Second Term Examination	5%	-
Project	-	10%
Mock Examination	-	5%
National Examination	-	70%
Total	100%	

10.0 Number of Periods

The Basic Applied Mathematics Syllabus for Advanced Secondary Education provides estimates of the time that will be spent in teaching and learning in consideration of the complexity of the specific competences and the learning activities. Four periods of 40 minutes each have been allocated for this subject per week.

11.0 Teaching and Learning Contents

The contents of this Syllabus are presented in matrix form with seven columns which include main competences, specific competences, learning activities, suggested methods, assessment criteria, suggested resources, and number of periods as presented in Tables 3 - 4.

Form V

Table 3: Detailed Content for Form V

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Use applied mathematical knowledge and skills	1.1. Use some advanced skills in geometry, trigonometry, and vectors to solve problems in different contexts	Explore some advanced tenets of trigonometry (<i>relationship of the secant, cosecant, and cotangent to the sine, cosine, and tangent, trigonometric identities: Pythagorean, compound and double angles</i>)	Exploration: Guide students through geometrical drawings, measurements, graphs and geometrical animations to explore the basic tenets of trigonometry	Some advanced tenets of trigonometry are well explored	Scientific calculator, graph papers, trigonometry animations, geometrical software	25
	1.2 Use functions and calculus to solve problems in different contexts	(a) Explore some advanced tenets of functions (<i>Properties, Domain and Range and graphs of cubic functions, rational functions with a constant numerator and a linear equation in the denominator, logarithmic, and exponential functions</i>)	Jig Saw: In groups assign students with a different types of functions to explore its tenets through concrete examples, graphs and function simulations and share the results through presentations	Some advanced tenets of functions are well explored	Graph papers, graphing calculator, Mathematical software such as MATLAB, Maple, Mathematica	88

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(b) Solve real life problems involving growth and decay	Scenario: Provide scenarios that shows the applications of algebra in solving growth and decay problems. Allow students to discuss, make follow up and provide feedback	Real life problems involving growth and decay are well solved	Scientific calculators, algebra animations, AI tools, Mathematical software such as Maple, GeoGebra, MATLAB, and Mathematica	
		(c) Explore the basic tenets of calculus (<i>Differentiation: first principles, power rule, chain rule, product rule, and quotient rule, Integration: substitution method</i>)	Group discussion: Organise students in groups to investigate the tenets of calculus through the use of Calculus books and technological tools	Basic tenets of calculus are well explored	Mathematical software such as Maple, GeoGebra, MATLAB, and AI tools	
		(d) Use differentiation methods to solve real life problems (<i>maximum and minimum, curve sketching, rate of change</i>)	Exploration: Guide students to solve real world problems and model them using tenets of differentiation	Uses of differentiation methods are well discussed		

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		<i>marginal cost and marginal revenue functions)</i>	through relevant books, ICT tools. Drill and practice: Guide students to perform several tasks on applications of differentiation in real life situations			
		(e) Use integration methods to solve real life problems (<i>area under the curve, volume of solid of revolution, cost and revenue functions</i>)	Problem solving: Individually or in groups, allow students to model and solve scenarios that reflects the application of integration in real life	Integration methods in solving real life problems are well discussed		
2.0 Use algebra, set theory, and logic to solve problems in different contexts	2.1 Apply knowledge of sequences and series in different contexts	Use sequences and series to determine simple and compound interest	Exploration: Organise students to explore the basic tenets of sequence and series	Sequences and series are used appropriately to determine simple and compound interest	Sequence and series charts, simple and compound interest calculators	27

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			<p>Guest speaker: Invite a guest speaker to guide students towards understanding on the applications of sequence and series in determining simple and compound interest</p> <p>Scenario: Provide a scenario that shows the applications of sequences and series in solving problems related to simple and compound interest</p>	determined by using concepts of sequences and series		
	2.2 Apply knowledge of algebra and number theory in different contexts	(a) Explore some advanced tenets of algebra (<i>simultaneous equations of one linear and one quadratic equation,</i>	Questions and answers: Assign students questions on algebra tenets and allow them to find answers	Some advanced tenets of algebra are well explored	Scientific calculators, Mathematical software such as Maple, GeoGebra, MATLAB, and AI tools	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		<i>graphs of direct and inverse variation and joint variation)</i>	through discussions, consulting relevant books and ICT tools and share their findings			
		(b) Apply algebraic and graphical methods to solve simultaneous equations involving one linear and one quadratic equation	Group discussion: Organise students in groups and provide practice tasks on finding solutions of simultaneous equations algebraically and graphically	Algebraic and graphical methods in solving simultaneous equations are well applied		

Form VI

Table 4: *Detailed Content for Form VI*

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
1.0 Use applied mathematical knowledge and skills	1.1 Use some advanced skills in geometry, trigonometry, and vectors to solve problems in different contexts	(a) Explore some advanced tenets of coordinate geometry (<i>area of a triangle, angle between two lines and perpendicular distance from a point to a line</i>)	<p>Discovery method: Allow students to contextualize coordinate geometry into everyday life and explore its tenets by hypothesizing, experiment, justify findings and share their conclusions.</p> <p>Drill and practice: Guide students to perform several tasks on the tenets of coordinate geometry</p>	Some advanced tenets of Coordinate geometry are well explored	Graph papers, geometrical models, shape and angles animations, AI tools, Mathematical software such as Maple, Geoboards GeoGebra, MATLAB, and Mathematica	48
		(b) Explore some advanced tenets of vectors (<i>unit vector, scalar</i>)	<p>Group discussion: Allow students to work in groups to relate vectors in</p>	Some advanced tenets of vector is well explored	Scientific calculators, Mathematical software such as	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		<i>product, angle between two vectors and work done by a constant force, derivative and integration of vector functions)</i>	everyday life and explore its tenets through visual representations, manipulatives, technological tools and reporting of findings Questions and answers: Equip students with suitable vector materials, assign them questions and allow them to present their findings		Maple, Geogebra, MATLAB, Mathematica, and AI tools	
	1.2 Use statistics to solve problems in different contexts	Explore some advanced tenets of statistics (measure of central tendency and dispersion:	Study tour: Organise a study tour and allow students to collect data from a visited	Some advanced tenets of statistics are well explored	Collected data, graph papers, scientific calculators,	38

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		<i>calculate mean by the coding method, variance, standard deviation, quartiles, and percentiles)</i>	<p>organisation. Guide them to explore some basic tenets of statistics and allow them to present their findings</p> <p>Questions and answers: Assign statistics questions and allow students to present and discuss their findings</p>		Mathematical software such as Maple, Geogebra, and MATLAB (computer packages)	
2.0 Use algebra, set theory and logic to solve problems in different contexts	2.1 Use set theory and logic in argumentation and decision making	(a) Explore advanced tenets of set theory (<i>operations involving three sets and cardinality of a set</i>)	Questions and answers: Equip students with sets materials, prepare questions for students to perform and present their findings.	Advanced tenets of set theory are well explored	Real objects, set simulations, charts of different sets, playing cards, manila papers, marker pens, colored chalks	54

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
			Group discussion: Organise students in groups and provide practice tasks on sets			
		(b) Explore the basic tenets of logic (<i>statements, connectives, truth table, arguments involving three propositions, electrical networks involving three propositions</i>)	Logic games: Guide students towards logic puzzles, games, and other iterative activities to enable learners understand the basic logic concepts	Basic tenets of logic are well explored	Logical argument Charts, switches, dry cells, water pipes, and logic networks animations	

Main competences	Specific competences	Learning activities	Suggested teaching and learning methods	Assessment criteria	Suggested resources	Number of periods
		(c) Use logic to analyse validity of arguments	Questions and answers: Equip students with suitable logic materials, prepare questions for students to perform, ask students to present their findings.	Logic is used correctly to analyze the validity of arguments	Logical argument Charts, switches, dry cells, water pipes, and logic networks animations	

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